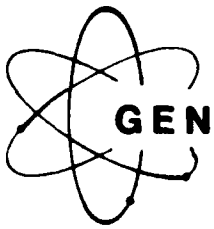
AD-A275 388

US Army Corps
of Engineers

The Hydrologic
Engineering Center



GENERALIZED COMPUTER PROGRAM

SID

Structure Inventory for Damage Analysis

DTIC
ELECTE
FEB 07 1994
S E D

User's Manual
March 1989

2048
94-04103

Original January 1982
Revised June 1987, March 1989

94 2 04 101

Approved for public release

Best
Available
Copy

SID

STRUCTURE INVENTORY FOR DAMAGE ANALYSIS

COMPUTER PROGRAM

Accesion For
NTIS CRA&I
DTIC TAB
Unannounced
Justification
By
Distribution /
Availability Codes
Dist | Avail and / or Special
A-1

USER'S MANUAL

March 1989

(Original January 1982)
(Revised June 1987, March 1989)

DTIC QUALITY INSPECTED 5

The Hydrologic Engineering Center
Water Resources Support Center
U.S. Army Corps of Engineers
609 Second Street
Davis, California 95616-4687
(916) 551-1748

Table of Contents

Appendices

List of Figures

List of Tables

Introduction

Background and Overview

The Structure Inventory for Damage Analysis computer program (SID) is designed to assist in the systematic and expeditious collection, management, and processing of data related to structures subject to flooding. The primary function of the program is to generate elevation-damage functions by user-designated damage categories and reaches. The resulting functions may be exposed to additional processing, such as the expected annual damage evaluations provided by the **Expected Annual Flood Damage Computation Program** (EAD-Hydrologic Engineering Center, 1984). The SID program also has been constructed to enhance the study of a variety of nonstructural flood plain management measures so that measures such as selected flood proofing, relocation, and raising of structures, can be accommodated in the damage function aggregation process. Single flood event damage values by category and reach may be directly determined based on user specifications.

An overview of flood damage evaluation concepts, requirements, and capabilities of the SID program are presented herein. In addition, the input necessary for program execution and related output are described in detail. Sample input and output have also been included to demonstrate the program capabilities and to assist the user in preparing input data for the program.

The SID program is maintained and distributed by the Hydrologic Engineering Center, Water Resources Support Center, U.S. Army Corps of Engineers, 609 Second Street, Davis, California 95616. This agency should be contacted for any questions regarding its use or availability.

Job-Size Limitations

The SID program is designed to accommodate individual users by use of dynamic arrays within the program. This enables considerable flexibility in specifying the number of damage reaches, damage categories, elevations for elevation-damage functions, single flood events to be analyzed, and the total number of damage functions. In general, the number of damage categories and damage reaches will be the limiting elements in the total size of a job that can be processed in a single run by SID. The variable names of the input categories are given below, as well as the expression needed to compute the maximum index value of the dynamic array.

Input Quantity	Variable	Data Record
Damage Reaches	NODR	J2
Damage Categories	NODC	J2
Elevations for the Elevation-Damage Relationship	IELV	J2
Single Flood Events	ITYPE	J1

$$(IELV + ITYPE + 15) * NODC * NODR \leq 25{,}000$$

Hardware and Software Requirements

The SID program was developed in FORTRAN IV using a CDC 7600 computer system. The source code has been converted to FORTRAN 77 and presently is supported on Harris minicomputers and MS-DOS compatible microcomputers. In general, it is compatible with other major computer systems. The HEC data storage system (HECDSS) provides the linkage between SID and EAD and is currently only available on MS-DOS compatible microcomputers and to the U.S. Army Corps of Engineers on Harris minicomputers. Work is underway to make the HECDSS compatible with most major computer systems.

File Assignments:

FORTRAN File Number	Keyword	Keyword Abbrev.	Description
5	INPUT	I	The standard input device from which SID input data is read. On the personal computer (PC), the default asignment is to the user's keyboard.
6	OUTPUT	O	The standard output device to which SID output is written. On the PC, the default assignment is to the user's monitor.
11	STRUCTURE	S	The local disk file name used when the structural data (SL, SD, SO records) resides on a sequential disk file. On the PC, the default assignment is to the file "SCRATCH.001".
12	DMGFUNC	D	The local disk file name used when the damage function data (DF, DP, PC (or DD) records) resides on a sequential disk file. On the PC, the default assignment is to the file "SCRATCH.002".
13	F13	F	The local disk file name used by the SID program as an unformatted scratch file for storing intermediary trace messages. On the PC, the default assignment is to the file "SCRATCH.031".
14	F14	F14	The local disk file name used by the SID program as a formatted scratch file for storing a copy of the input data records. On the PC, the default assignment is to the file "SCRATCH.003".
71	DSSFILE	DS	The local disk file name used for a HECDSS data file when storing aggregated elevation-damage data. On the PC, the default assignment is to the file "SCRATCH.032".
92	DFRECS	DF	The local disk file name used when the damage function selection data (DF records) reside on a sequential disk file. This implies that the damage function data (DF, DP, PC (or DD) records) reside on a direct access disk file (see File98). On the PC, the default assignment is to the file "SCRATCH.004".
98	RANDMG	R	The local disk file name used when the damage function data (DF, DP, PC (or DD) records) reside on a direct access disk file. On the PC, the default assignment is to the file "SCRATCH.033".

Flood Damage Analysis and Information Processing

Overview

The SID program has been developed to assist in evaluating the flood damage potential of an area based on assessments of individual (or small groups of) structures. The program addresses the portion of the flood damage assessment process that involves the development of elevation-damage functions by damage categories and damage reaches. The resulting functions may be linked either manually or automatically via HECDSS to other programs for computation of expected annual damage and inundation reduction benefits.

The evaluation of the flood damage potential of a stream reach is performed in several phases. Figure 1 is an overview schematic of the process commonly used within the Corps of Engineers. The role of the SID program is shown. The process consists of three primary functions associated with flood damage assessments: (1) inventory of field survey data; (2) analytical programs for evaluations; and (3) data management and processing procedures.

Field Survey and Evaluation Procedures

The nature of the field survey and information gathering process is dependent upon whether the selected evaluation process is based on 1) individual structures or 2) areal capture of the damage potential using spatial analysis concepts. Evaluations involving individual structures may be performed by exhaustive surveys of the individual (or small groups of) structures, or by surveys of sample structures considered representative of the study area. Typically, the inventory/survey seeks to identify and catalog the structures, assign values, and determine reference elevations. Field survey information requirements and the information inventorying process are discussed in more detail in Appendix B.

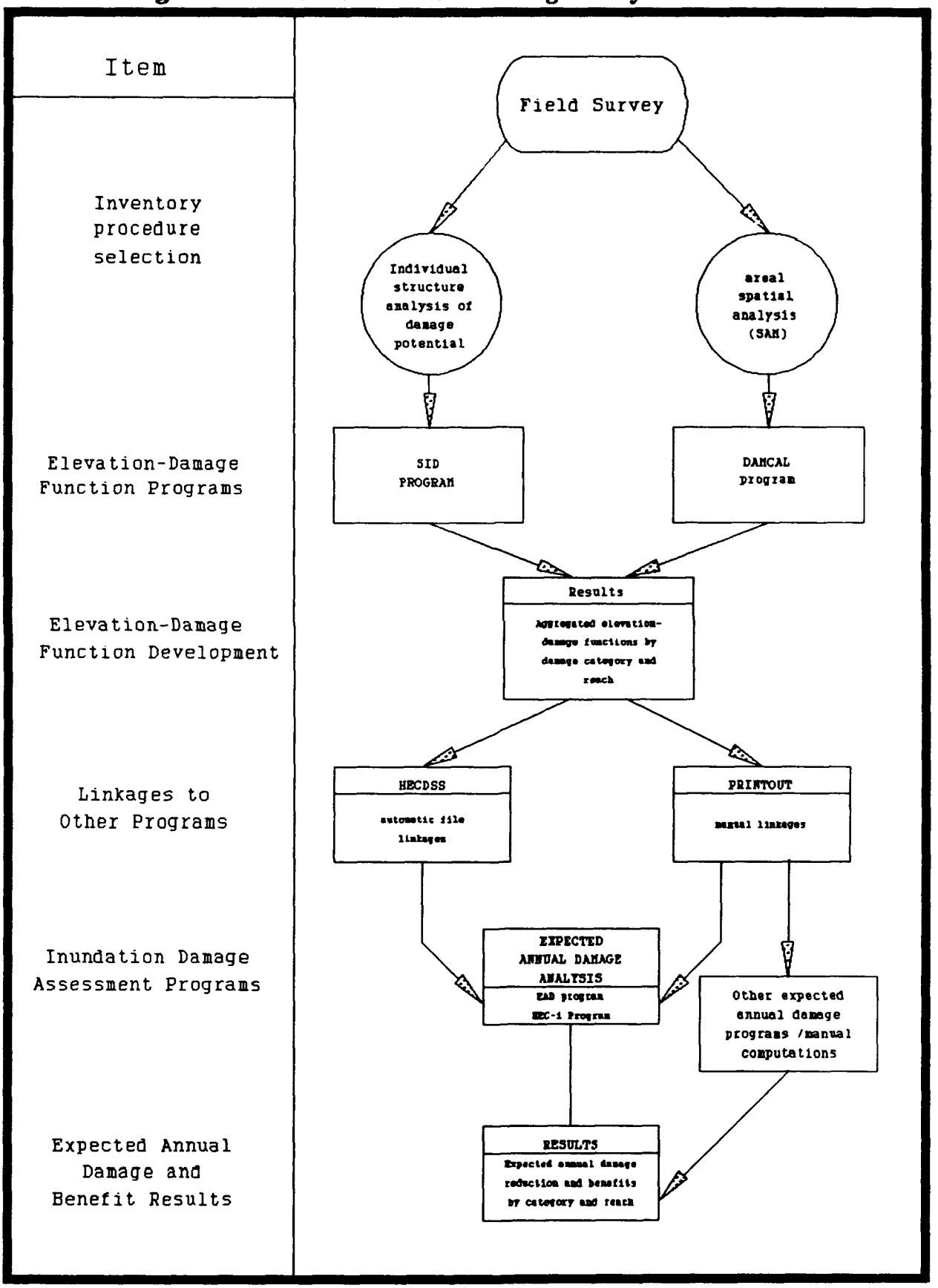
Elevation-Damage Function Development

The SID program processes structure inventory data to develop elevation-damage functions. Information requirements are: reference structure and flood elevation data, damage potential of individual structures, value of structures and contents, and damage reach delineations. Data processing options for the SID program are described in more detail in Appendix C. The SID program outputs elevation-damage functions by damage category and reach.

Program Interface and Damage Computations

The SID program has been developed to enable automatic data transfer with other computer programs for computations of expected annual damage and inundation reduction benefits. The process uses special software called the HEC Data Storage System (HECDSS). For most investigations the Expected Annual Flood Damage Computation (EAD) program is most applicable for direct calculations of expected annual damage and inundation reduction benefit values. The HEC-1 (Hydrologic Engineering Center, 1987) program may be utilized for optimization or other analyses of flood control system components (structural and/or nonstructural) measures are desired. The technical aspects of the data transfer are largely transparent to the user. Data transfer to these programs (or others desired by the user) may also be performed manually. The HEC training document "Flood Damage Analysis Package" (Hydrologic Engineering Center, 1988) provides a detailed description, user guidance, and an example of data transfer between HEC programs. The HEC document "Flood Damage Analysis Package On The Microcomputer, Installation and User's Guide" (Hydrologic Engineering Center, 1988) provides a detailed description of the installation and operation of the FDA Package (including the SID program) on the microcomputer. Appendix C describes these procedures in more detail.

Figure 1: Overview of Flood Damage Analysis Procedures



Damage Reach Delineation

The study area, both floodplain and contributing watershed, must be partitioned into analysis subunits to accommodate many data, analysis, and reporting needs. Calculation of damage is performed for specific locations within the larger study area. Hydrologic and flood damage potential data must be developed and accurately aggregated to these locations to enable efficient and accurate computations to be performed. Defining the aggregating areas (they are normally referred to as damage reaches) and selecting the location within each area (referred to as the index location) that is representative of the area should be done with care. Important factors that should be considered in delineating the damage reaches and selecting index locations are - from the hydrologic engineering perspective: location of stream gages, location of major watershed subdivisions (eg. tributaries, watershed computer model computation locations etc.), consistent (parallel) water surface profiles for a range of flow, stable location included for developing rating curves, and hydrologic engineering information needs for flood-loss mitigation measure formulation and evaluation. Factors that are important from the economic analysis perspective are: distribution of existing and projected future flood plain development, data reporting boundaries such as counties, and coop districts, and economic information needs for flood-loss mitigation measure formulation and evaluation. Other factors that may be important are: local government/special district boundaries for which planning information will be reported and matching/comparing results with previous Corps studies and/or local agency studies.

Capabilities and Computation Procedures

Overview

Computational capabilities described herein include procedures for aggregating damage functions, selecting structure damage potential, evaluation of nonstructural flood loss mitigation measures, and single event analyses. TABLE 1 summarizes the general analytical capabilities of the SID program in evaluating various types and conditions of flood loss mitigation measures.

Table 1: SID Analysis Capabilities

	Existing Development Condition	Future Development*
Do Nothing (without Conditions)	X	X
Structural Flood Control Measure	X	X
Nonstructural Measures		
Permanent Actions		
• Flood Proof	X	X
• Raise	X	X
• Relocate	X	X
Flood Plain Regulations		X
Preparedness Temporary Actions	X	X
• Content Adjustments (raise/remove)	X	X
• Damage Mitigation (perimeter barriers, seals, closures)	X	X

*Location, type, and attributes of new structures must be defined by the user.

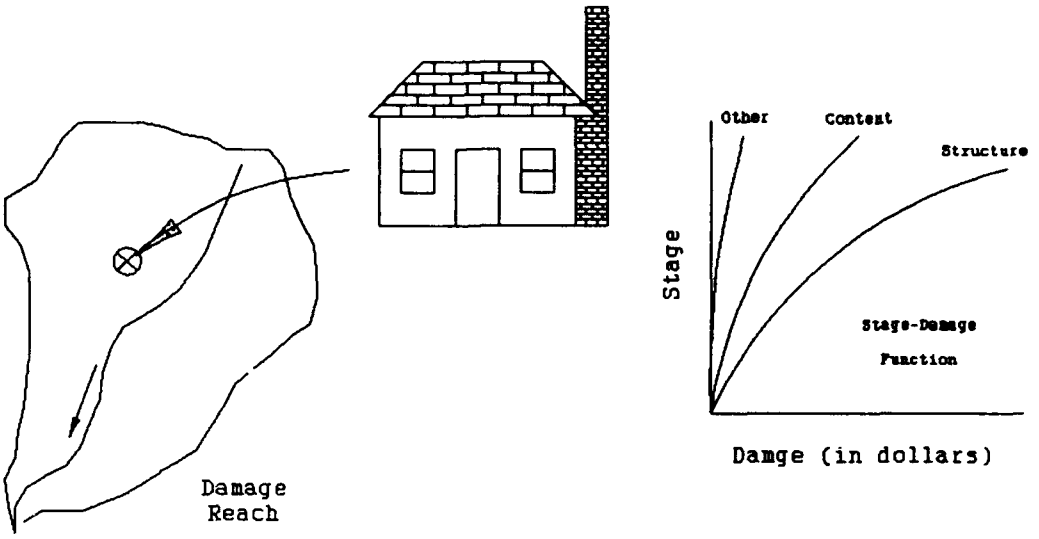
Aggregation of Damage Functions

Aggregation of elevation-damage functions by damage category and damage reach to damage reach index locations constitutes the fundamental analytical capability of the SID program. The aggregate functions are derived by summing stage-damage functions of individual structures, by damage category and reach, considering the structure elevation and nature of the flood profiles. The basic process is outlined below.

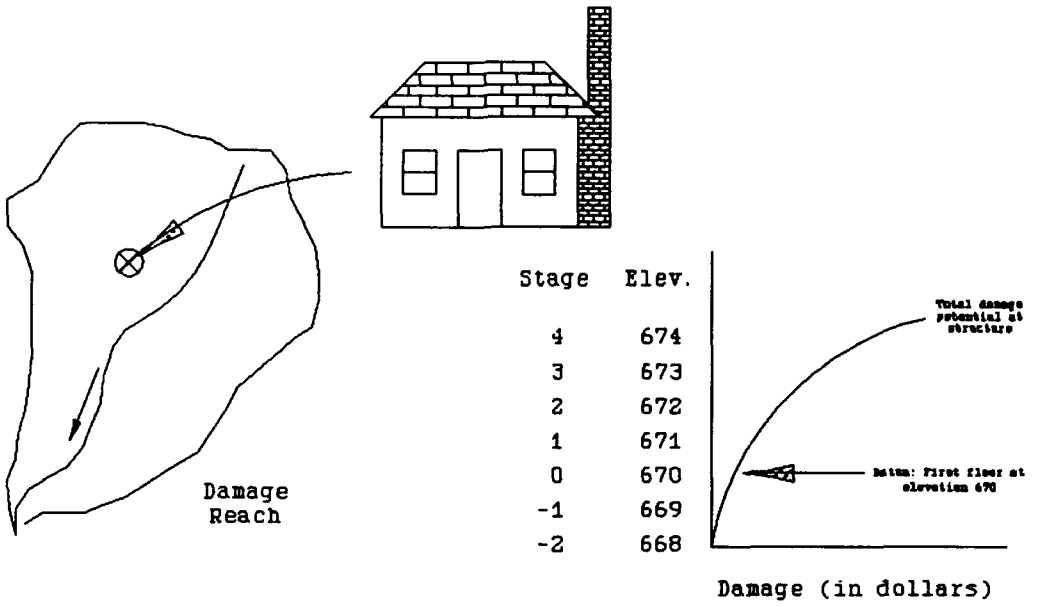
(1) Stage-damage functions are developed for individual structures from the appropriate generalized stage-percent damage function (or direct dollar damage function) for the specific structure (Figure 2a).

(2) The stage values are converted to elevation by equating zero stage to a specific elevation (usually first floor elevation). Figure 2b illustrates this process.

Figure 2: Elevation-Damage Function Development at Structure



(2a) Damage category (single family residential, heavy industrial, strip commercial, etc.) stage-damage functions.



(2b) Conversion of stage to elevation based on reference datum associated with the structure.

(3) The next step in the aggregation process is to adjust the elevation scale for each structure to correspond to the datum at the index location. This adjustment is required to account for the slope of the water surface profiles throughout the damage reach. The reference flood concept is used in the adjustment process. A reference flood is defined as a flood profile representative of the range of flood profiles that are expected to occur. Flood profiles from hypothetical or historic events may be used, but is advisable to use a computed profile from a hypothetical or standard event (e.g., 50-yr., 100-yr. event). The difference between the reference flood water surface elevation at the structure and the reference flood water surface elevation at the index location is computed and the elevation scale adjusted. Figure 3 shows a structure located upstream of an index location with difference in reference flood elevations of 3 feet. For this case, elevations of the structure elevation-damage function are red by 3 feet to complete the translation procedure.

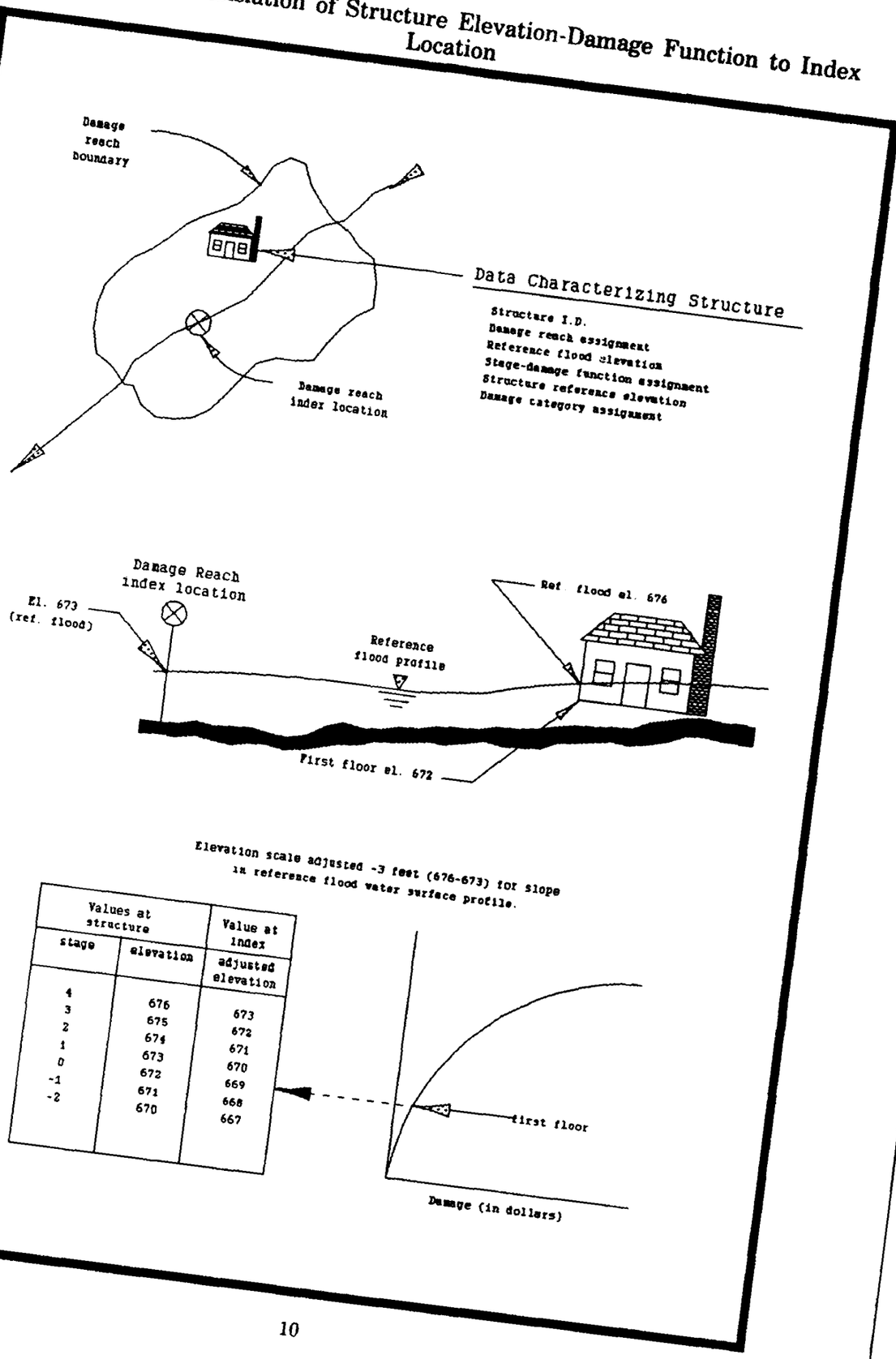
(4) The final step is to sum the elevation-damage functions for each reach at the respective index location. Aggregate functions are formed by summing the adjusted elevation-damage function of each structure with those of other structures assigned to the same damage category and reach. TABLE 2 shows the aggregation process.

An example summary output of the computed aggregated damage functions for the various damage categories is shown in TABLE 3. The table depicts five damage categories of a particular reach with the damage functions of each structure assigned to a damage category and aggregated to the index location of the reach. The total aggregated elevation-damage function for the reach (summation of the individual functions) is also provided. The aggregation procedure described is the same for all SID program executions, whether evaluating existing or future structures for with and without proposed measures conditions.

Table 2: Damage Aggregation Process

STRUCTURE A ELEVATION-DAMAGE FUNCTION AT INDEX LOCATION		STRUCTURE B ELEVATION-DAMAGE FUNCTION AT INDEX LOCATION		TOTAL ELEVATION-DAMAGE FUNCTION AT DAMAGE REACH INDEX LOCATION	
Elevation (feet)	Damage ($ x 10^3)	Elevation (feet)	Damage ($ x 10^3)	Elevation (feet)	Damage ($ x 10^3)
.....	.....	662	0	662	0
.....	.....	663	1.1	663	1.1
.....	.....	664	4.7	664	4.7
.....	.....	665	5.2	665	5.2
.....	.....	666	10.7	666	10.7
667	0	667	12.3	667	12.3
668	0.8	668	14.2	668	15.0
669	1.2	669	17.6	669	18.8
670	2.0	670	20.3	670	22.3
671	3.6	671	35.0	671	38.6
672	5.0	672	37.4	672	42.4
673	7.0	673	41.0	673	48.0

Figure 3: Translation of Structure Elevation-Damage Function to Index Location



Values at structure		Value at index
stage	elevation	adjusted elevation
4	676	673
3	675	672
2	674	671
1	673	670
0	672	669
-1	671	668
-2	670	667

Table 3: Aggregated Damage Functions At The Index Location

TABLE 3

Aggregated Damage Functions
At The Index Location
($1,000)

Elev m.s.l	Single Family Residential	Multi-Family Residential	Public Facilities	Heavy Industrial	Unimproved Pasture	Total Damage
654	0.0	0.0	0.0	0.0	0.0	0.0
655	0.5	0.0	0.1	0.0	0.0	0.6
656	1.2	0.0	0.4	0.0	0.0	1.6
657	1.4	0.0	0.4	0.0	0.1	1.9
658	1.5	0.0	0.4	0.0	0.1	2.0
659	1.6	0.0	0.4	0.0	0.1	2.1
660	1.9	0.0	0.4	0.0	0.1	2.4
661	2.4	0.0	0.4	0.0	0.1	2.9
662	2.8	1.1	0.4	1.2	0.2	5.7
663	3.1	5.5	0.4	1.2	0.2	1.4
664	3.2	14.7	0.4	20.4	0.2	38.9
665	3.4	19.9	0.4	86.1	0.3	110.1
666	3.7	26.8	0.4	175.9	0.3	207.1
667	4.0	36.4	0.4	267.5	0.3	308.6
668	4.2	47.9	0.4	325.1	0.4	378.0
669	4.4	71.6	0.4	372.2	0.4	449.0
670	4.4	71.6	0.4	420.6	0.4	497.4
671	4.6	91.0	0.5	422.8	0.5	519.4

Structure Criteria and Damage Functions

Several options are available for stipulating structure information and other data necessary to define the damage potential associated with individual structures. Input data for a structure include: structure characteristics (identifier, damage category, and location); monetary values (building, contents and other items, i.e., landscaping, outbuildings); reference structure and flood elevations; and stage-damage relationships defining the damage potential corresponding to stages of inundation.

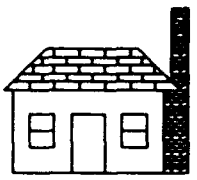
Stage-Damage Functions

Stage-damage relationships are provided to the SID program on DF, DP and PC (or DD) records. There are a maximum of nine (9) different types of stage-damage functions allowed. The function may consist of a single composite (total) function including the building, its contents, and any other items such as outbuildings and landscaping, or three (3) individual relationships for the structure, contents, and other items. In addition, three unique functions may be defined for each floor level (basement, first floor, and second floor), or a single function may be defined for the total range of stage inundation. The damage potential associated with the stages may be specified as a direct dollar value or as a percentage of total structure value.

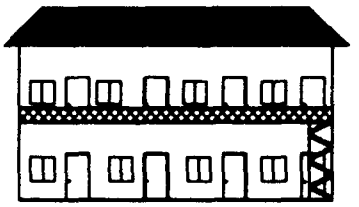
The stage values may constitute a range of negative (typically below first floor) to positive values. Figure 4 illustrates the major user options available for defining the stage-damage functions. Subsequent paragraphs elaborate on the data input requirements and options.

Figure 4: Structure Damage Evaluation Specifications

Single Story
Residential Structure



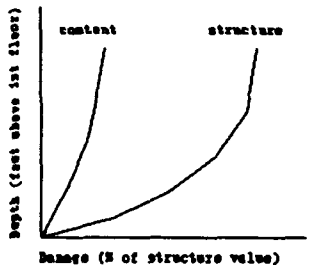
Two Story
Commercial Structure



Structure Data

Damage Reach	=	IDRCH	(SL.1)
Building Identification	=	IBLDG	(SL.2)
Damage Category	=	IDCAT	(SD 3)
Reference Flood Elevation	=	ABJ	(SL.5)
Structure Reference Elevation	=	STOPO	(SL.6)
'New' Structure	=	NEWSTR	(SL.10)
Damage Potential Function	=	IDUF	(SD.4)

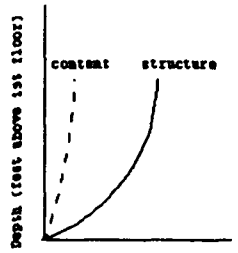
Damage Function Input Options



Stage-percent damage functions

If STOPO (SL.6)=0. functions must be elevation-damage

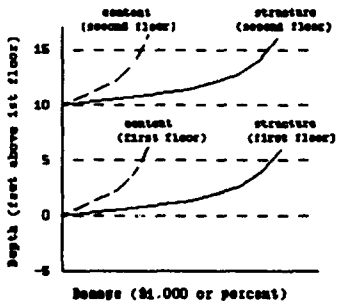
Stage values	=	DP Records
Damage Function Option	=	IDF (DF.3)=0
Percent Damage Values	=	PC Records
Structure Value	=	VIFS (SD.4)
Content Value	=	VIFC (SD.5)
Other Value	=	VIFO (SD.6)



Stage-dollar damage functions

If STOPO (SL.6)=0. functions must be elevation-damage

Stage values	=	DP Records
Damage Function Option	=	IDF (DF.3)=0
Percent Damage Values	=	PC Records
Structure Value	=	VIFS (SD.4)
Content Value	=	VIFC (SD.5)
Other Value	=	VIFO (SD.6)



Stage-Damage Functions by Floor Level

If STOPO (SL.6)=0. functions must be elevation-damage

Stage values	=	DP Records
Damage Function Option	=	IDF (DF.3)
Percent Damage Values	=	PC Records
Direct Damage Values	=	DD Records
Structure Content and 'Other' Values For Each Floor	=	SO Record

- Stage-damage functions are defined by stage values on DP records and corresponding damage values on the PC or DD records. The PC records are used if damage values are input as percentages, IDF (DF.3) = 0; DD records are used when damage values are input directly as actual values, IDF (DF.3) = 1. Direct dollar damage input is typical for small numbers of structures or for structures having unique stage-damage characteristics, such as industrial or commercial buildings. FIGS. 4a and 4b show the two options of specifying damage values. When the damage values are input as a percentage, the total dollar value of the structure, its contents and other items must be input as data variables V1FS (SD.4), V1FC (SD.5) and V1FO (SD.6), respectively. These date variables are multiplied by the percent damage values to develop the damage values corresponding to the range of stages.

- Stage-damage functions may be specified as a single function throughout the entire elevation (stage) range, IFUNC (SL.10) = 0, or as a unique function for up to three levels (basement, first floor and second floor), IFUNC (SL.10) = 1, 2 or 3. Figure 3c illustrates the latter option for first and second floors only. The SO record is used to define the damage functions for the individual levels.

- Stage-damage functions for contents and other items may be derived as a percentage of the structure damage function. Data variables VBC (SO.4) and VBO (SO.5) are used to derive the damage values for contents and other items, respectively.

- Elevation-damage functions for each of the three options shown in Figure 3 may be used instead of stage-damage functions by specifying a structure reference elevation, STOPO (SL.6), equal to zero.

Structure Information

The structure identification data specifies the title or code of the structure, its location, and the designated damage category. The structure identification code IBLDG (SL.2) is used to store and retrieve data for the structure. The damage reach identification code IDRCH (SL.1) specifies the damage reach location of the structure. Data variables ROWN (SL.3) and COLE (SL.4) are optional and used to define the row (north) and column (east) coordinate points of the structure. Any rectangular coordinate system may be used, such as row/column or the Universal Transverse Mercator (UTM) system. The coordinate location option is provided to assist in locating the structure for future reference and for interfacing with a spatial data bank for possibly obtaining other pertinent data (i.e., topographic and reference flood elevations). The topographic and reference flood elevations may be obtained manually from cartographic sources or automatically from coordinate-based data files.

Additional structure information (not presently used in the analysis) may be included on the optional SS and SA records. These data include soil types, structure attributes (i.e., construction material, foundation types, number of windows, size of openings), and the street address and zip code of the structure.

Reference Elevations

Two reference elevations are required at each structure: 1) a structure reference elevation to convert stage-damage functions to elevation-damage functions; and 2) a reference flood elevation used to translate and aggregate damage functions to damage reach index locations. The use of the reference flood was previously described. Consequently, the following paragraphs discuss the structure reference elevation and related options. These include capabilities to adjust for basement floors, lowest openings, and specification of ground elevations for first floor elevation. Figure 5 depicts the data variables and summarizes associated input requirements and options.

The first floor elevation corresponds to the zero stage value of the stage-damage function (DF, DP, PC, or DD records) for the structure. The structure reference elevation usually reflects the first floor elevation; but it may also correspond to the ground elevation. If the structure reference elevation reflects the

ground elevation, the elevation is subsequently adjusted to the first floor by the addition of DELTG (SL.9) as shown in Figure 5. The elevation-damage function of the structure is subsequently generated based on the developed structure reference elevation corresponding to zero stage relationship.

Data variable DELTB, the difference between the elevation of the basement floor and the first floor, is required if separate stage-damage functions are to be applied for the first floor (and second floor) and the basement. Data variable DELTZ, the difference between the water surface elevation at the initial damage value and the first floor elevation, is required if the zero damage elevation does not properly define the water surface elevation where damage starts. For example, as shown in Figure 5 a basement opening exists that would admit flood waters only at some elevation above the basement floor, and therefore, damage would not begin until the water reached that elevation. The basement stage-damage function should not reflect the basement floor elevation with respect to the structure reference elevation. (The stages in a basement damage function should start at zero and DELTZ would most often be negative.)

Damage Categories

Damage categories are used to consolidate the large number of structures into specific groups of similar characteristics for analysis and reporting purposes. The descriptions of categories to be used in the analysis and displays are specified on DC records. The damage potential for a structure typically consists of damage associated with the structure, contents, and "other" items. However, potential damage to contents may be separated in the accounting and display by utilizing the CC records. This option enables direct reporting of the potential damage to contents and periodic updating of content values due to affluence.

The CC records specify and describe content damage categories to be evaluated and displayed. Damage potential to contents are subsequently not accounted for in the specified categories of the DC record, but are instead aggregated as defined CC record content categories. Figure 6 depicts the concepts of content damage categories. (Also see variable descriptions on DC and CC records in Appendix E.) For instance, a total of five damage categories are desired: low density residential (DC records), medium density residential (DC records), industrial (DC records), residential contents (CC records), and industrial contents (CC records). Content damage potential values are conceptually removed from the low and medium residential categories and grouped under a residential category (Figure 6). Industrial contents are displayed in a similar manner. A total of five categories are subsequently displayed. Analyses or aggregation of the content damage categories is performed precisely like that of other categories. Aggregation of damage categories for single event flood damage analyses may be specified on AC records.

Damage Reaches

Damage reaches are used to define limits of consistent data for analyses and economic displays. Damage reach data are specified on DR records. Specifications of the damage reach code, reference flood elevations, and reach target elevations for nonstructural analyses are defined on the DR record. Aggregation of damage reaches for single event flood damage analyses may be specified on AR records.

Figure 5: Damage Function Construction Concepts

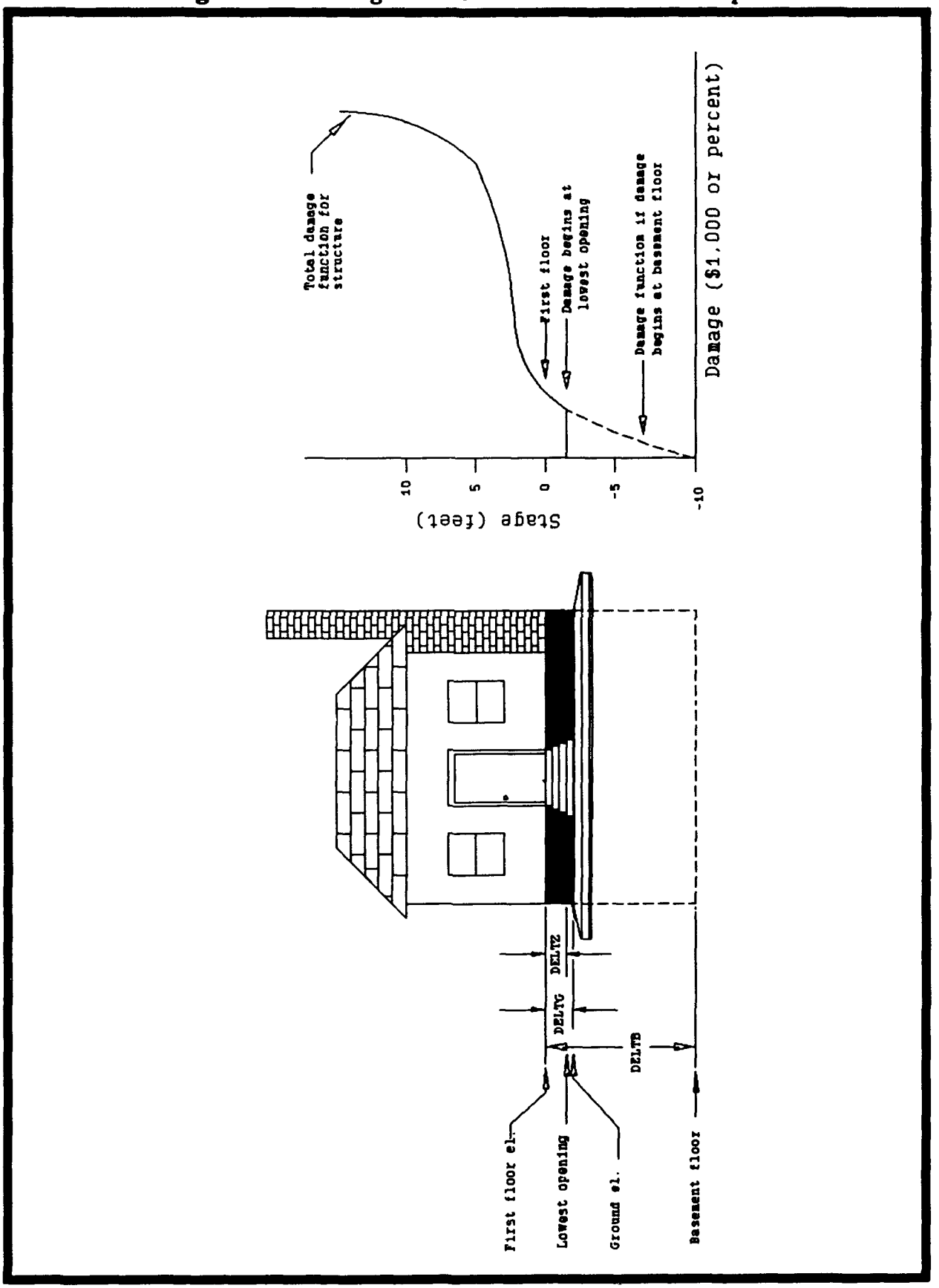
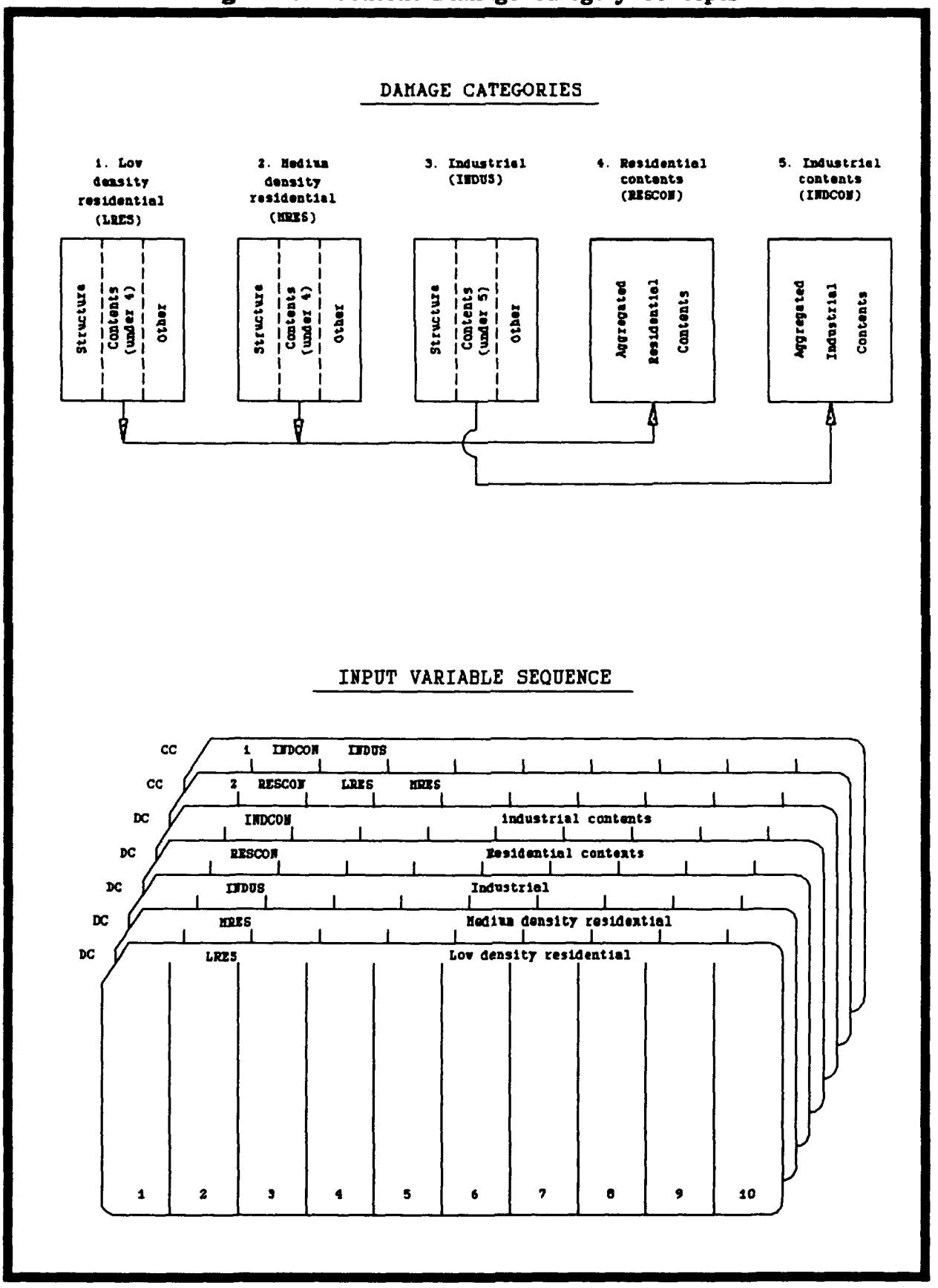


Figure 6: Content Damage Category Concepts



Nonstructural Flood Mitigation Measures

The capability of the SID program to process and manipulate elevation-damage functions makes the program a powerful instrument for evaluating nonstructural flood mitigation measures. The measures that can be analyzed are as follows: flood proofing (permanent or temporary actions), raising (permanent for structures and temporary for contents), and relocation or demolition of the structure.

Nonstructural analyses may be performed for all structures of a specified damage category, only new structures of a specified damage category, or for individual structures. The J1 record specifies the types of nonstructural analysis and the nature of the structures to be evaluated for the job. New structures are defined as those associated with future development and are to be evaluated during future condition analyses. Structure characteristic data, reference elevations, and stage-damage functions are defined as previously described. Data variable NEWSTR (SL.10) is used to designate new structures associated with potential future development.

Flood Proofing

Flood proofing measures that may be evaluated using the SID program may be either permanent or temporary measures. Permanent measures include flood walls, closures, and sealant materials around the exterior of the structure. Temporary measures, usually associated with individual or group flood fighting efforts include sand bags, perimeter earthen dikes, flashboards, and closures. The evaluations may be performed for specific individual structures, all structures of designated damage categories, or only "new" structures associated with user specified damage categories. The type of flood proofing analyses is designated by data variable IPROF (J1.2).

The flood proofing assessments may be performed using either of two conceptually different means of implementation: 1) specified height of protection above zero damage elevation or 2) specified target flood level of protection. Figure 7 depicts the two concepts. The first method flood proofs designated structures to a specified height above the zero damage elevation. For example, all designated structures would be flood proofed 2.0 feet, providing varying levels of protection for the structures in the reach. The height of flood proofing may vary by individual structures or damage categories as specified on the J5 and J6 records. The general procedure is as follows:

- If a uniform height of flood proofing is specified for a damage category, then the damage functions of all structures assigned to that damage category are modified (the program actually truncates damage functions for buildings and contents, damage functions for "other" are not modified). It should be noted that the process could be repeated for many damage categories.

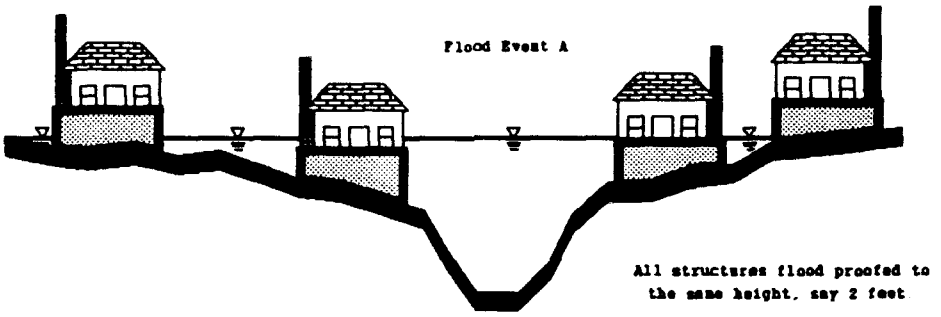
- An elevation-damage function is then developed for each structure in the damage reach, using the modified damage functions, and assigning topographic elevations to the various stage values (the damage function at the structure would be the modified or truncated).

- The elevation-damage functions are then adjusted based on the difference in reference flood elevations between individual structures and the index location and aggregated according to damage classification using procedures previously described.

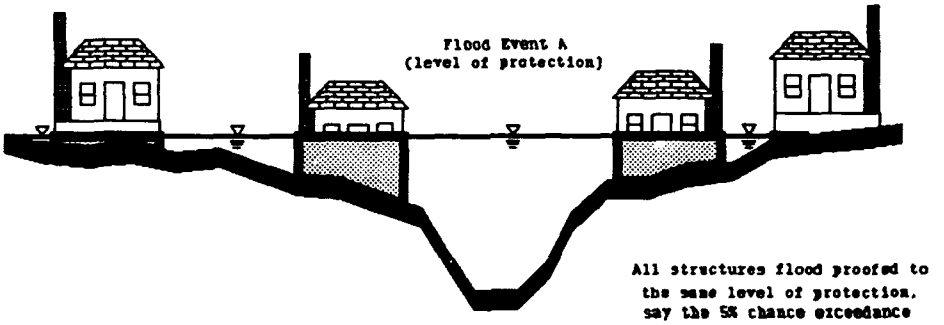
It is possible, in a single computer run, to flood proof as many damage categories as desired and to have a unique flood proofing level for each category.

Figure 7: Flood Proofing Concepts

Flood Proofing To Specified Height Above Zero Damage Elevation



Flood Proofing To Specified Flood Target Level



Note: shaded area represents amount of flood proofing for each structure

Flood proofing structures to a specified target flood level provides uniform protection to the structures. For example, all specified structures are designed to be flood proofed to the elevation of the 20-year exceedence frequency event. Typical measures include permanent walls and earthen dikes around groups of structures and temporary flood fighting measures implemented for groups of structures. The user is cautioned to consider the physical feasibility of flood proofing structures since some measures may not be physically feasible for the feet of protection indicated. The amount of flood proofing of individual structures is summarized on the output.

Flood proofing selected damage categories to a specified target flood protection level (within a given damage reach) requires the computation of the depth of flooding at each structure resulting from a flood event equivalent to the protection level specified. If a structure is inundated by that flood event, it is then flood proofed to an elevation corresponding to the depth of flooding (Figure 7).

The water surface elevation at the index location which corresponds to the desired target flood protection level is determined and input to the SID program. The corresponding target flood protection level (elevation) is then computed for each structure using the reference flood. The inundated structures are subsequently flood proofed to protect against the specified event.

The stage damage function for a structure with a first floor elevation of 420.0 feet is shown in Figure 8. The reference flood elevation at the index location is 427.0 feet and the desired target protection elevation is 425.5 feet. The difference in water surface elevations at the index location is -1.5 feet (425.5 - 427.0). The difference is added to the reference flood elevation of the structure (424.5 feet) to yield a corresponding target protection elevation (424.5 - 1.5) of 423.0 feet, as indicated in Figure 8. The elevation damage-function is then truncated as shown in Figure 9 and aggregated to the index location in the usual manner.

A summary of the flood proofing concepts, options, significant data variables, and input records is presented in Figure 9.

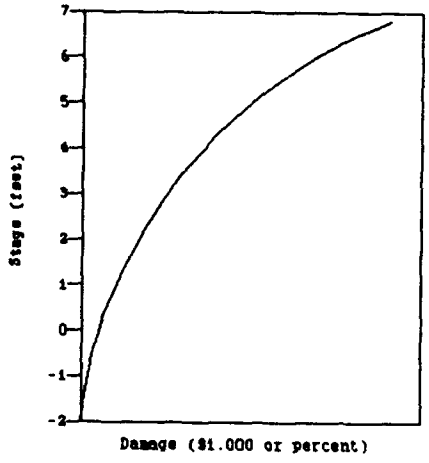
Raising of Structures and Contents

The SID program provides the following nonstructural options for the elevation of buildings, permanent raising of existing development (structure and contents), elevation of future (new) structures based on regulatory development policies, and temporary emergency elevation of contents to mitigate flood damage. The evaluations may be performed for all structures in a damage category, only "new" structures (future development), or for only specified individual structures. The type of raising analysis is designated by the user by data variable IPOL (J1.1).

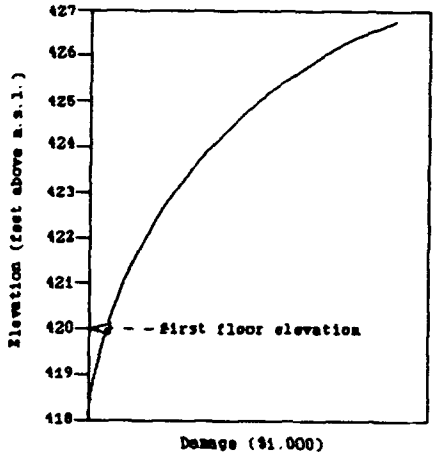
The analysis of raising existing structures or future structures subjected to flood plain regulation makes use of the reference flood to determine the effected flood plain area. The elevation of the regulatory flood (flood plain area) at the index location is determined by procedures similar to those described for flood proofing damage reaches to a specified flood levels. When the computed regulatory (or design frequency) flood event water surface elevation is higher than the zero stage of the structure, the resulting damage function for the structure is elevated so that the zero stage elevation is the same as the flood event water surface elevation. The corresponding change in the elevation-damage function is shown in Figure 10. For a flood plain regulatory or project design elevation of 423.0 feet in Figure 10, the elevation-damage function must be raised 3 feet to reflect the placement of ground elevation or zero stage at or above the regulated flood plain.

A summary of analytical capabilities of the SID computer program to raise existing structures or future structures under flood plain regulatory policies is provided in Figure 11. Important associated concepts, data variables, and record input requirements are also provided.

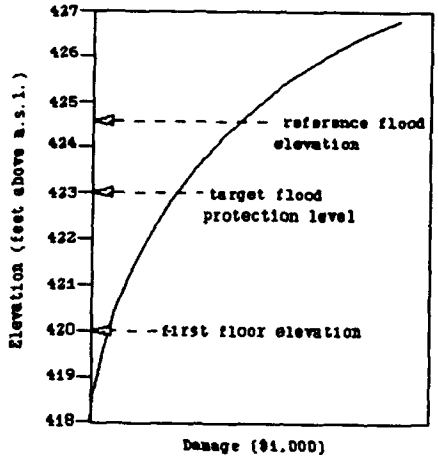
Figure 8: Flood Proofing Procedure For Target Flood Level of Protection



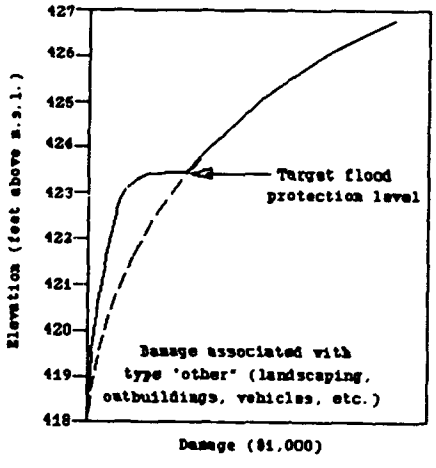
(a) Stage-Damage Function of Structure



(b) Elevation-Damage Function of Structure



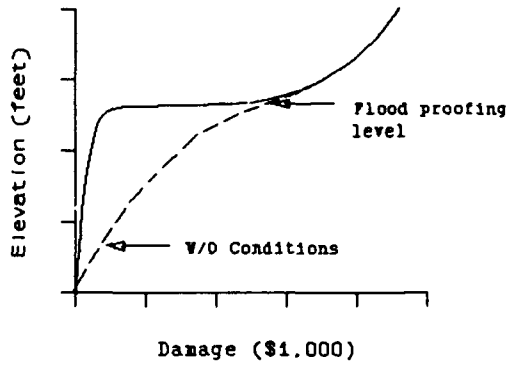
(c) Elevation-Damage Function with Reference Flood and Target Flood Protection Level



(d) Truncated Elevation-Damage Function of Structure

Figure 9: Flood Proofing Options

Permanent and temporary flood proofing measures include the installation of perimeter barriers (walls, dikes, sandbags, etc.), closures and sealant materials on the structure.

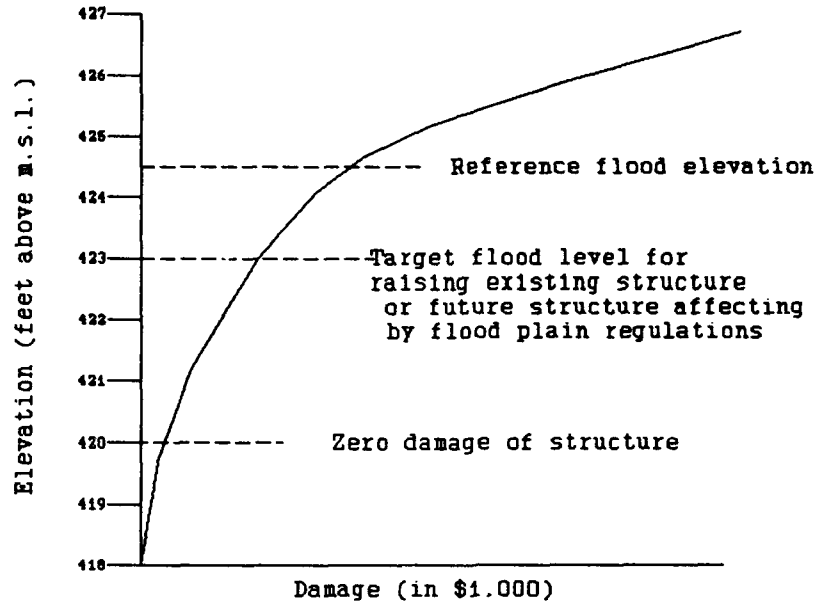


Flood proofing measures mitigate damage by preventing flood waters from inundating the structure and contents,effectively truncating the damage function. The measures are typically viable for up to 2 - 3 feet on a structure.

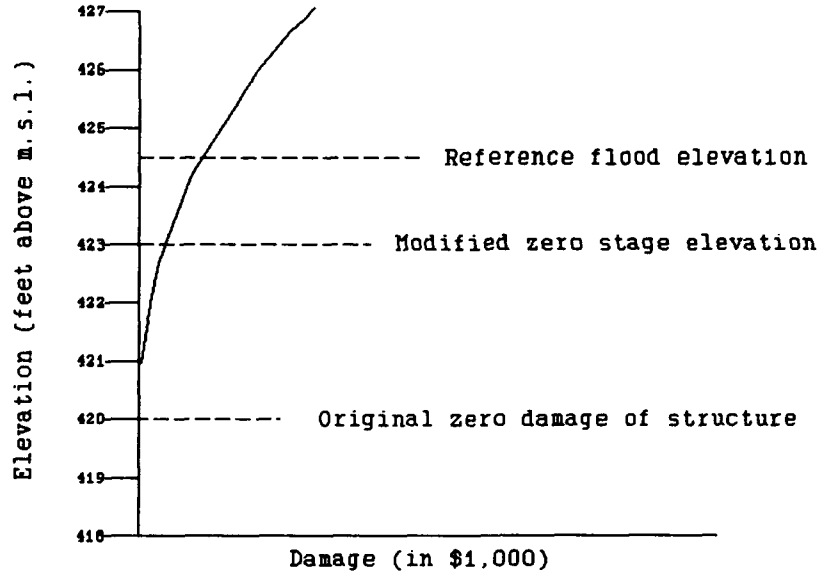
SID FLOOD PROOFING OF STRUCTURES OPTIONS

- All structures within specified damage categories are flood proofed to a uniform specified height (i.e., 2.0 ft.) with respect to the first floor. IPROF (J1.2) = 3, use J5 and J6 records.
- Only "new" structures within designated damage categories are to be flood proofed to specified target flood levels. IPROF (J1.2) = 2, use J5 and DR records.
- All structures of specified damage categories and reaches are flood proofed to specified target flood levels (uniform degree of protection). IPROF (J1.2) = 1, use J5 and DR records.
- Only "new" structures are to be flood proofed to a specific height with respect to first floor. IPROF (J1.2) = 4, use J5 and J6 records.
- Only specific structures are to be flood proofed to a specified height or to a target flood elevation. IPROF (J1.2) = 5, use J7 and DR records.

Figure 10: Analysis Procedure of Raising Existing or Future Structures



(a) "Without" condition elevation-damage function

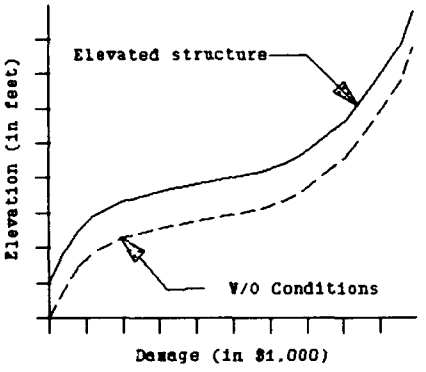


(a) "Without" condition elevation-damage function

Figure 11: Raising of Structure Options

RAISE EXISTING OR FUTURE STRUCTURE AND CONTENTS

Raising of structure and associated content analyses may be performed for existing structures or to evaluate regulatory development policies for future development. Temporary raising of contents in conjunction with preparedness planning actions may also be evaluated.



Raising of structures and/or contents mitigates damage by reducing the frequency of flooding. The function is adjusted upwards in elevation corresponding to the amount of elevation raise specified.

SID RAISING OF STRUCTURES OPTIONS

- Raise all structures within specified damage categories and reaches to a designated flood level. IPOL (J1.1) = 1, use J3 and DR records.
- Raise only "new" structures within specified damage categories to be raised above a designated flood level. IPOL (J1.1) = 2, use J3 and DR records.
- All structures within specified damage categories are to be raised a specified amount. IPOL (J1.1) = 3, use J3 and JA records.
- Only "new" structures within designated damage categories are to be raised a specified amount. IPOL (J1.1) = 4, use J3 and JA records.
- Raise specified existing or "future" individual structures to a target level of protection. IPOL (J1.1) = 5, use J4 and DR records.
- Temporarily raise contents. This option requires manual adjustment in the elevation-damage function for contents.

Relocation of Structures

Relocation of structures is defined as relocation of inhabitants and mitigation of the damage potential associated with the structure either by moving the structure from the flood threatened area or demolition of the structure in place.

Temporary emergency evacuation of mobile homes or removal of contents also falls within the purview of "relocation" nonstructural alternatives presented herein. Evaluation capabilities of the SID program provide for analysis of all structures of a specified damage category, only "new" (future development) structures of the specified category, or specified individual structures.

Computational procedures are similar to those described for flood proofing and raising of structures. Instead of a truncated or elevated damage function, a "no-damage" function is aggregated to the index location. Two options are available for determining if a structure should be relocated. Either the zero stage (elevation) below the specified flood level for implementation or the zero damage elevation below the targeted flood level may be used.

Figure 12 presents an overview of the SID program capability to analyze relocation of structures. Also included are key data variables and the input required to perform specific analysis.

Single Event Damage Computations

The SID program has the capability to calculate inundation damage values associated with user-defined single flood events (e.g., historic, frequency, Standard Project, or Probable Maximum). Multiple events may be evaluated in a single program execution with output by damage category, damage reach, and total damage associated with each event. The calculations (interpolations) are performed for each structure before the program aggregates structure elevation damage functions to the damage reach index locations. This capability is extremely useful because it eliminates the necessity of user interpolation of the elevation-damage functions for the corresponding output items.

The user must specify the number of single events to be analyzed, ITYPE (J1.8). A maximum of ten (10) events may be evaluated in a single program execution. The elevations of the events at the damage reach index locations are input on the SE records in increasing order. Summary output options of single event analyses are indicated by variable IAG (J1.9).

Table 4: Elevation-Damage Function

Elevation Ft. m.s.l.	Damage $1,000
635	0
636	10
637	12
638	62
639	65
640	120

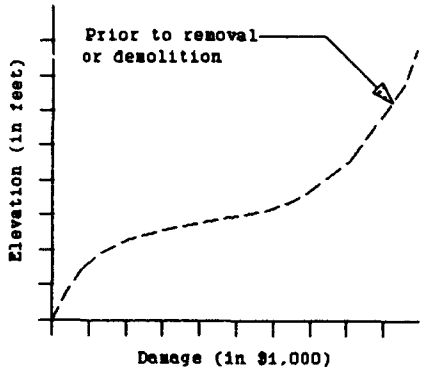
The automatic program interpolation of damage functions to determine single event damage values is more accurate than manual interpolation. To illustrate the potential difference, TABLE 4 shows the elevation-damage function output at an index location for a single damage category and reach. If the 50-year flood event for the index location is 637.5 feet, a user might interpolate linearly between the elevations 637 and 638 feet in estimating the damage at $37,000. What is not known is whether the value of $62,000 for elevation of 638 feet represents a large number of structures with a tenth of a foot of flooding or a small number of structures experiencing greater depths of flooding. In the former case, an elevation of 637.5 could result in a relatively insignificant increase in damages from that shown at an elevation of 637 feet ($12,000). In the latter case, the $37,000 estimate could be reasonable approximation of the damage due to a 50-year event.

The J1 record variable ITYPE (J1.8) specifies if single event calculations are to be performed, and IAG (J1.9) specifies if damage categories and reaches are to be aggregated. The water surface elevations for each event analyzed are input on the SE record for the index location. Up to 10 events may be evaluated during one program execution. The water surface elevations must be specified in

Figure 12: Relocation of Structure Options

RELOCATION OF STRUCTURES AND CONTENTS

Permanent relocation/temporary evacuation of structures and contents are implemented for existing structures. Permanent relocation of structures actually refers to removal of the damage potential which may be performed by physically moving the structure or relocating the residents and demolition of the structure. Temporary evacuation implies removal of the structure (mobile homes) and/or contents associated with the structure during a flood event.



Relocation of structures from the threatened area essentially removes the damage potential associated with individual structures.

SID RELOCATION OF STRUCTURES OPTIONS

- All structures are to be relocated (or demolished) within designated categories and reaches which have a zero damage elevation below the specified flood level. IEVAC (J1.3) = 1, use J8 and DR records.
- Only new structures are to be relocated within designated damage categories which have a zero damage elevation below the specified flood level for implementation. IEVAC (J1.3) = 2, use J8 and DR records.
- Relocate all structures within designated damage categories with a zero damage elevation below specified flood level for implementation IEVAC (J1.3) = 3, use J8 and DR records.
- Only new structures within specified categories are to be relocated if the zero damage elevation is below specified flood level for implementation. IEVAC (J1.3) = 4, use J8 and DR records.
- Only specified individual structures with zero damage elevation below flood level for implementation will be relocated. IEVAC (J1.3) = 5, use J9 records.
- Removal of all or percentage of contents. Manually adjust elevation damage function for contents appropriately.

ascending order. The ST record enables users to provide titles for each of the analyzed single events. Single events analyzed may be either hypothetical (frequency, Standard Project or Probable Maximum) or historical events. A zone summary table, i.e., number of structures inundated between each single event, may be output as specified by ITYPE (J1.8).

Flood Zone Summaries

Flood zone summaries display the number of structures and damage potential between specified flood elevations. A zone summary is automatically output when single event damage analyses (SE records) are performed. Zone summaries included the following: number of structures with elevations of first floor in a flood zone, number of structures with elevations of zero damage in a flood zone, and the total dollar value associated with structures which have first floor elevations within specified flood zones.

Future Condition Analysis

The SID program may be used to evaluate future development scenarios based on corresponding structure and associated damage potential information. Data requirements are identical to that of existing structures including identification, location and values, reference elevations, and stage-damage data derived from the future development condition designated for analysis. Future development evaluations may be the most probable future or other future alternatives to access the sensitivity and stability of the flood mitigation measures over the projected life of the measures.

Future structures are identified by data variable NEWSTR (SL.10) which enables analysis of structures that presently do not exist but are projected to exist at a future date. User options on the J1 record enable the evaluation of all structures (existing and future), only future (new) structures, or only structures individually specified for analysis.

Sampling Capability and Procedures

The SID program may be used to forecast the damage potential of the study area from representative sample data when study and resource constraints prohibit exhaustive inventories of individual structures. This capability is especially beneficial for study areas involving large numbers of structures and/or when the level of study detail does not warrant exhaustive data collection. The damage projections using sampled structure data may be performed using ISAMP (J1.10) to designate that all or some damage categories are samples, as specified on the D3 record. The results of the sampled structure damage potential data are scaled based upon the percentage of sampled structures of each category over the projected number of actual structures of the category.

Input Preparation

General Description

This section describes the basic input structure of the SID program. Specific input information presented includes definition of the program hierarchy, type of records needed to perform desired analysis, and general information to be entered on each input record. Detailed program input description is provided in Appendix E. Appendix A provides a glossary of input data variables and Appendix D provides example problem descriptions and associated input requirements and output results.

Program Data Hierarchy

The general hierarchy of the input structure for the program is displayed in TABLE 5. The program is designed for the user to specify job titling, desired analysis performance, and output specifications.

Table 5: Program Data Hierarchy

TITLE RECORDS	
JOB RECORDS	
• Defines Analysis Specifications • Specifies Damage Function Information • Specifies Nonstructural Analysis Criteria	Applies to each job.
OUTPUT TRACE RECORDS	
DAMAGE RECORDS	
• Defines Stage-Damage Relationships • Defines Damage Categories • Damage Reach Specifications	Applies to each damage category and damage reach.
SINGLE EVENT DAMAGE RECORDS	
• Water Surface Elevation • Title of Event	Applies to each single event analysis.
STRUCTURAL RECORDS	
• Structure Specifications Data • Damage Evaluation Criteria • Structure Data to be Stored • Structure Location Data	Applies to each structure.

Data Records Description

Title Records:
T1, T2, T3

Three title records are **required**. They provide output display information used to readily identify the project and job. The content of the title records is optional, but it is suggested the records include the project name, data notes, selected program options, and any unique features of the job. The information on the title records is printed at the top of each page of the computer printout.

Job Records: J1 through J9

The job records specify criteria and analysis options required for program execution.

- **First Job Record: J1**. This **required** record specifies the type of analysis to be performed (existing or future without condition, flood proofing, raising, relocation, etc.), the printout option, single event evaluation options, and sampling option.
- **Second Job Record: J2**. This **required** record specifies basic information on damage functions, damage categories, damage reaches, file management, and miscellaneous control codes.
- **Third Job Record: J3**. An optional record(s) used to define damage categories to be subjected to raise-to-target elevation analysis.
- **JA Record**: An optional record(s) used to specify the target amount when raising structures of designated damage categories on the J3 cards.
- **Fourth Job Record: J4**. An optional record(s) used to identify structures to be subjected to raise-to-target elevation analysis.
- **Fifth Job Record: J5**. An optional record(s) used to specify damage categories to be subjected to flood proofing analysis.
- **Sixth Job Card: J6**. An optional record(s) used to define the depth of flood proofing for corresponding damage categories on the J5 card.
- **Seventh Job Record: J7**. An optional record(s) used to specify the individual structures to be flood proofed and the flood proofing criteria associated with each structure.
- **Eighth Job Record: J8**. An optional record(s) used to specify the damage categories to be subjected to relocation analysis.
- **Ninth Job Record: J9**. An optional record(s) used to specify individual structures to be relocated.

Evaluation Priority Record: OA

An optional record used to establish the priority in which several nonstructural measures (raise-to-target, flood proofing, and relocation) are considered for analysis. If not specified differently by this card, the order defaults to (1) raise-to-target, (2) flood proofing, and (3) relocation.

Trace Records: TR, TS, TM

Optional records which specify the trace output desired for each program execution.

- **Trace Output for Job Record: TR.** An optional record(s) used to specify the type of trace output to be obtained for the job.
- **Trace Output for Structure Record: TS.** An optional record(s) used to specify the structures to be traced. A maximum of 100 structures may be traced.
- **Trace Output for Damage Reach Card: TM.** An optional record(s) which specifies damage reach and damage category combinations to be traced.

HEC Data Storage System Record: ZW

An optional record specifying the pathname used by the HECDSS when storing elevation-damage functions for later use by the EAD Program.

Damage Function Records: DF, DP, PC, DD

Required records that may be stored on separate direct access or sequential disk files or may be included in the record input stream.

- **Damage Function Specification Record: DF.** Specifies the number of stage values in the stage-damage function, identifies the type of damage values, and type of input file.
- **Stage Values Record: DP.** Stage values for stage-damage functions.
- **Percent Damage Values Record: PC.** Percent damage values corresponding to stage values on DP record.
- **Direct Damage Values Record: DD.** An optional record used instead of the PC (percent damage) record. The input data specified are the actual damage values of the structure. This option is typically used for unique industrial or commercial buildings. The values correspond to stage values on DP records.

Damage Category Consolidation Records: DC, CC

Required data records that define damage categories and content categories.

- **Damage Category Consolidation Record: DC.** A required record that defines damage categories (low density residential, commercial, industrial, etc.) used to consolidate potential damage values of individual structures. The damage category is used for summary printouts and computer data file transfer.

Damage Function Records: DF, DP, PC, DD (continued)

- **Content Damage Category Consolidation Record: CC.** An optional record used to consolidate content damage into separate categories for evaluation and display. A set of CC records is required for each content damage category specified by the DC records.

Damage Reach Records: DR, DT, SE, D3, ST, AC, AR

Damage reach records are required for each reach to be analyzed. The DR and DT records are required and specify water surface elevation and titling data for the reach. The SE, D3, ST, AC and AR records are optional and are used to specify single event evaluation criteria, scaling adjustments for analysis based on samples of structures, and damage reach output specifications.

- **Damage Reach Water Elevation Data Record: DR. A required** record that specifies relevant water surface elevation data at the index location within the reach. Water surface elevation data requirements include reference flood elevation and target elevations used to evaluate potential implementation of flood proofing, raise-to-target, and relocation actions.

- **Damage Reach Title Record: DT. A required** record providing an alphanumeric description or identification of the damage reach.

- **Single Event Analysis Water Surface Elevation Record: SE.** An optional record used to specify water surface elevations at the index location of each damage reach for analysis of single flood events. Single events may include historic, frequency, Standard Project or Probable Maximum floods.

- **Scaling Adjustments to Damage Function Records: D3.** An optional record used to scale (adjust) the consolidated damage category functions for the damage reach. The functions are adjusted as the reciprocal of the percentage value specified.

- **Single Event Titling Record: ST.** An optional record that provides titling information for the single events specified on the SE records.

- **Single Event Damage Category Output Consolidation Record: AC.** An optional record used to specify a reduced set of damage categories for summary output of single flood event analysis results.

- **Single Event Damage Reach Output Consolidation Record: AR.** An optional record used to specify a reduced set of damage reaches for output summary of single event analysis.

Structure Inventory Records: SL, SD, SO, SS, SA

These records represent structure inventory data to be subjected to damage potential analysis. The SL and SD records are required. The SO record is optional and enables users to specify damage functions by floor levels (basement, first floor, and second floor). The SS and SA records define structure attributes and characteristics. They are not presently used in analyses, but have been defined for potential future applications.

- **Structure Characteristics Record: SL.** The **required** record provides identification codes, locational information, structure elevations, and printout controls.
- **Structure Damage Potential Data Record: SD.** The **required** record is used to specify the damage category (for potential damage consolidation), damage function assignments, and values associated with the structure, contents, and other items.
- **Structure Damage Analysis by Levels Record: SO.** This optional record provides for the evaluation of structures at three levels: first floor, above first floor, and basement.
- **Structure Information Cataloging Record: SS.** An optional record for cataloging more detailed information on the structure (building identifier, age, soil type, type of structure, etc.) This record is planned for potential future use (not yet developed) to enable more detailed economic and nonstructural flood mitigation evaluations.
- **Structure Address Cataloging Card: SA.** An optional record for cataloging the address of the structure. The record has no present analytical utility and is included for future use.

End of Structure Data Record: ES

A **required** record after the last set of structure records (SL-SA) denoting the end of the structure data.

Output Display

Overview

The description of output is accompanied by a sample printout. The output display includes selected printed pages and does not include the entire echoed input data (job control cards, stage damage functions, etc.) or the damage reach aggregated damage functions. Numbers in parenthesis in the text refer to notes that appear on the sample output display.

Description of Example Output

Banner Page

A title page including the program name, program version date (1), and program execution date and time (2) is provided.

Input Listings

A display of the input data is provided at user request (3).

Title

Title record information is printed at the top of each output page (4).

Job Records

Job record data are initially displayed in a record image format prior to a more descriptive definition of the variables. The variable and input values follow with a brief description of each variable.

- **Analysis Information: J1 Record.** An image of the required J1 record is displayed (5) and a description of coded input values given (6).
- **Damage Function Generation Specifications: J2 Record.** The required J2 record is shown in record image format (7) and the values associated with damage functions and data file structure are displayed and identified (8).

Data Record Images

Images of data records are output as shown (9).

Stage-Damage Functions

Stage-damage functions generated from input data used in the development of elevation-damage relationships at individual structures are shown (10).

Damage Categories

Specified damage category titles and maximum nonstructural analysis values (flood proofing, raising, etc.) are displayed (11).

Index Location Summary

A damage reach index location data summary is provided (12) to enable users to verify input reach data.

Single Event Information

Input data for single event damage analyses are shown by title (13) and water surface elevations (14).

Structure Inventory Data Summary

The damage potential data for each structure is printed out as follows:

- **Structure and Damage Reach Data.** Location, damage reach, and category data are provided (15).
- **Dollar Value of Structure.** Total structure, content, and other damage category values associated with the structure are given (16) along with the identification of the stage-damage function (17) used in the analysis.
- **Damage Data.** Values used to develop the damage function for each damage category are tabulated in the output. Column titles are related to the input variables shown below:

  STAGE = STAGE (I), DP Record (18)
  W.S.E. AT INDEX = Calculated water surface elevation (19)
  STRUCTURE DAMAGE FIRST FLOOR (20)
  CONTENT DAMAGE FIRST FLOOR (21)
  OTHER DAMAGE FIRST FLOOR (22)
  STRUCTURE DAMAGE BASEMENT (23)
  CONTENT DAMAGE BASEMENT (24)
  OTHER DAMAGE BASEMENT (25)
  TOTAL DAMAGE (26)

- **Single Event Damage.** Dollar damage values associated with single flood events are given (27).

Trace Example of Damage Category

Trace printout options are specified on the J1 and J7 Records. Identification of damage categories and reaches (28) to be traced and structure and reach data (29) are provided. Generated elevation-damage function values from user-specified trace requirements are given in tabular form (30). Output generated is one page per structure.

Nonstructural Analysis Summary

Defines nonstructural modifications made to structures in a reach (31).

Structure Elevation Zone Summary

The output reflects the number of structures and associated values by damage reach based on user-specified flood zones (single event floods). The output tables are defined by the following:

- Damage reach identification (32).
- Number of structures by damage category located in specified flood zones based on reference elevation of structure (SL.6 - STOPO) (33).
- Number of structures by categories located in specified flood zones based on structure zero damage elevation (34).
- Structural value by categories located in specified flood zones based on reference elevation of structure (35).

Damage Reach Aggregation Summaries

Damage reach summaries depicting elevation-damage functions by damage categories are developed and output by the SID computer program. The following results are output by damage reach:

- Damage reach identification and title (36).
- Table of damage reach categories (37).
- Summary of single event damage values by damage categories (38).

```
*********************************************************
*       Structure Inventory for Damage Analysis         *
*       Users Manual (June 1987)                        *
*       Version  February 21, 1989                      *
*       IBM-PC Compatible (MS)                          *
*       Run date 21FEB89   time 16:44:44                *
*********************************************************

     SSSSSSSS   IIIIIIII   DDDDDDD
     SS            II      DD     DD
     SS            II      DD     DD
     SSSSSSSS      II      DD     DD
           SS      II      DD     DD
           SS      II      DD     DD
     SSSSSSSS   IIIIIIII   DDDDDDD

     ****************************************
     *  U.S. Army Corps of Engineers        *
     *  The Hydrologic Engineering Center   *
     *  609 Second Street, Suite B          *
     *  Davis, California 95616             *
     *  (916) 551-1748                      *
     ****************************************
```

(1) Program version date

(2) Program execution date and time

List of Input Records for This Run ⟶ *(3) Input listing*

```
T1                 TEST 1 - OUTPUT DISPLAY
T2            SID - STRUCTURE INVENTORY OF DAMAGE
T3                      MARCH 1989
J1                                         1               7
J2    15      4       2     1.0            1      18       1
TR     3                              1
TM   DR1APARTMTS    DR1S.F.RES.
DF   MH1      9
DP   -1.     0.      1.      2.      3.      4.      5.      6.      7.
PC    0.     8.     50.     71.     82.     87.     89.     91.     91.
DF   MH2     10
DP   -1.     0.      1.      2.      3.      4.      5.      6.      7.      8.
PC    0.     3.     30.     56.     72.     79.     84.     87.     88.     90.
DF   HR5     20
DP     0      1       2       3       4       5       6       7       8       9
DP    10     11      12      13      14      15      16      17      18      19
PC     0      1       8      14      18      22      25      28      29      30
PC    32     36      41      45      48      51      54      57      60      63
DF   HR6     20
DP     0      1       2       3       4       5       6       7       8       9
DP    10     11      12      13      14      15      16      17      18      19
PC     0      4      23      32      38      45      50      53      55      55
PC    55     58      63      65      72      77      82      87     100     100
DF   HR7     12
DP     0      1       2       3       4       5       6       7       8       9
DP    10     11
PC     0      4       9      16      27      39      51      65      74      83
PC    91     91
DF   HR8     10
DP     0      1       2       3       4       5       7       9      10      11
PC     0      6      11      19      32      47      61      87     100     100
DF   LR1     10
DP    0.     1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.     5.     20.     28.     33.     36.     41.     43.     46.     48.
DF   LR2     10
DP    0.     1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.     6.     35.     45.     53.     64.     73.     79.     84.     90.
DF   LR3     12
DP  -10.    -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.     1.
PC    0.    4.6    11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC  67.9   67.9
DF   LR4     12
```

```
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.    5.7    13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
PC  100.    100.
DF   LR5      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17.
DP   18.     20.     25.
PC    0.      2.      4.      7.      9.     12.     14.     17.     20.     25.
PC   32.     43.     59.
DF   LR6      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17
DP   18.     20.     25.
PC    0.      5.     12.     19.     29.     41.     58.     73.     87.     89.
PC   92.     96.     96.
DF   LR7      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.    2.5     10.     14.    16.5    18.0    20.5    21.5    23.     24.
DF   LR8      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.    1.5    8.75   11.25   13.25    16.0   18.25   19.75    21.0   22.5
DF   C10      12
DP     0      .5       1       2       3       4       5       6       7       8
DP     9      10
PC     0      12      27      49      64      77      85      89      93      94
PC    95      95
DC      MOBL HOM              MOBILE HOMES
DC      APARTMTS              APARTMENTS
DC      S.F.RES.              SINGLE FAMILY RESIDENCE
DC      COMMERCL              COMMERCIAL
DR   DR1   494.5                          485
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
DR   DR2   503.6                          498
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
SL   DR1MOBHOME1                  491.5   491.0
SD   DR1MOBHOME1MOBL HOMMH1  20.MH2   7.       MOBILE HOME
SL   DR1MOBHOME2                  491.3   489.0
SD   DR1MOBHOME2MOBL HOMMH1  15.MH2   5.       MOBILE HOME
SL   DR1MOBHOME3                  493.6   494.1
SD   DR1MOBHOME3MOBL HOMMH1  25.MH2  10.       MOBILE HOME
SL   DR1   APT01                   493.0   494.8          -10.        1
SD   DR1   APT01APARTMTSHR5 780.HR6 281.       13 APARTMENTS            (1SWB)
SO   DR1   APT01HR7 625.HR8 225.
SL   DR1   APT02                   494.2   493.7
SD   DR1   APT02APARTMTSHR5 880.HR6 325.       22 APARTMENTS        (COMPOSITE)
SL   DR2   RES01                   503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.       SINGLE FAMILY RESIDENCE   (1SNB)
```

(3) *Input listing continued*

```
SL   DR2   RES02                    503.5   503.0    -2.0                1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.        LR5  50.LR6  25.
SL   DR2   RES03                    503.8   504.5                    1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                       LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

(3) Input listing continued

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

(4) Title record information

J1 0 0 0 0 0 1 0 7 0 0

(5) J1 record image

This job will perform the following

(6) Display of J1 record input values

IPOL = 0, No raise-to-target elevation analysis to be considered for this computer run

IPROF = 0, No flood proofing analysis to be considered for this computer run

IEVAC = 0, No structure relocation will be considered for this computer run

IPRNT = 0, Normal Output

ITRACE = 1, Trace output desired

ITYPE = 7, Number of single events for which damage is calculated

IAG = 0, No aggregation of single event damage

ISAMP = 0, No sampling conversion

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

```
J2   15      4      2   1.00      0      1     18      1      0
```

(7) J2 record image

Job Processing Information

(8) Display of J2 record input values

```
NODF   =   15  Number of Damage Functions

NODC   =    4  Number of Damage Categories

NODR   =    2  Number of Damage Reaches

AGG    = 1.00, Aggregation interval (in feet)

NFILE  =    0, Structure information file

IMAGE  =    1, Images of input records will be listed and echoed as read

IELV   =   18, The number of elevations to be calculated for the
               elevation-damage relationships

IMARK  =    1, The total (structure+contents+other) value will be used
               for the structure value flood zone summary

NDFILE =    0, Damage function file
```

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

DF	MH1	9	0	0						
DP	-1.0	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	.0
PC	.0	8.0	50.0	71.0	82.0	87.0	89.0	91.0	91.0	.0
DF	MH2	10	0	0						
DP	-1.0	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
PC	.0	3.0	30.0	56.0	72.0	79.0	84.0	87.0	88.0	90.0
DF	HR5	20	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
DP	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0
PC	.0	1.0	8.0	14.0	18.0	22.0	25.0	28.0	29.0	30.0
PC	32.0	36.0	41.0	45.0	48.0	51.0	54.0	57.0	60.0	63.0
DF	HR6	20	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
DP	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0
PC	.0	4.0	23.0	32.0	38.0	45.0	50.0	53.0	55.0	55.0
PC	55.0	58.0	63.0	65.0	72.0	77.0	82.0	87.0	100.0	100.0
DF	HR7	12	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
DP	10.0	11.0	.0	.0	.0	.0	.0	.0	.0	.0
PC	.0	4.0	9.0	16.0	27.0	39.0	51.0	65.0	74.0	83.0
PC	91.0	91.0	.0	.0	.0	.0	.0	.0	.0	.0
DF	HR8	10	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	7.0	9.0	10.0	11.0
PC	.0	6.0	11.0	19.0	32.0	47.0	61.0	87.0	100.0	100.0
DF	LR1	10	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
PC	.0	5.0	20.0	28.0	33.0	36.0	41.0	43.0	46.0	48.0
DF	LR2	10	0	0						
DP	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
PC	.0	6.0	35.0	45.0	53.0	64.0	73.0	79.0	84.0	90.0
DF	LR3	12	0	0						
DP	-10.0	-9.0	-8.0	-7.0	-6.0	-5.0	-4.0	-3.0	-2.0	-1.0
DP	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0
PC	.0	4.6	11.2	16.4	21.3	28.6	33.3	42.7	54.2	63.9
PC	67.9	67.9	.0	.0	.0	.0	.0	.0	.0	.0
DF	LR4	12	0	0						
DP	-10.0	-9.0	-8.0	-7.0	-6.0	-5.0	-4.0	-3.0	-2.0	-1.0

→ *(9) Example record image of input data set*

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

→ *(10) Input stage-damage functions*

Stage Damage Functions

MH1		MH2		HR5	
Stage	Percent Damage	Stage	Percent Damage	Stage	Percent Damage
-1.00	.00	-1.00	.00	.00	.00
.00	8.00	.00	3.00	1.00	1.00
1.00	50.00	1.00	30.00	2.00	8.00
2.00	71.00	2.00	56.00	3.00	14.00
3.00	82.00	3.00	72.00	4.00	18.00
4.00	87.00	4.00	79.00	5.00	22.00
5.00	89.00	5.00	84.00	6.00	25.00
6.00	91.00	6.00	87.00	7.00	28.00
7.00	91.00	7.00	88.00	8.00	29.00
9999.00	91.00	8.00	90.00	9.00	30.00
9999.00	91.00	9999.00	90.00	10.00	32.00
9999.00	91.00	9999.00	90.00	11.00	36.00
9999.00	91.00	9999.00	90.00	12.00	41.00
9999.00	91.00	9999.00	90.00	13.00	45.00
9999.00	91.00	9999.00	90.00	14.00	48.00
9999.00	91.00	9999.00	90.00	15.00	51.00
9999.00	91.00	9999.00	90.00	16.00	54.00
9999.00	91.00	9999.00	90.00	17.00	57.00
9999.00	91.00	9999.00	90.00	18.00	60.00
9999.00	91.00	9999.00	90.00	19.00	63.00
9999.00	91.00	9999.00	90.00	9999.00	63.00

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

```
DC      MOBL HOM     .00     .00MOBILE HOMES
DC      APARTMTS     .00     .00APARTMENTS
DC      S.F.RES.     .00     .00SINGLE FAMILY RESIDENCE
DC      COMMERCL     .00     .00COMMERCIAL
```

Damage Categories

Damage Cat.	Damage Category Title	POLMAX	PRFMAX
MOBL HOM	MOBILE HOMES	.00	.00
APARTMTS	APARTMENTS	.00	.00
S.F.RES.	SINGLE FAMILY RESIDENCE	.00	.00
COMMERCL	COMMERCIAL	.00	.00
OTHER	OTHER DAMAGE CATEGORIES	.00	.00

(11) Damage category titles and maximum nonstructural analysis values for regulatory policies (POLMAX) and flood proofing (PRFMAX) analyses of nonstructural measures.

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

```
DR   DR1   494.5      .0      .0      .0   485.0      .0      .0      .0      .0
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
DR   DR2   503.6      .0      .0      .0   498.0      .0      .0      .0      .0
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
```

Damage Reach Index Location Summary ——————→ *(12) Damage reach index location data summary*

Reach I.D.	Ref Flood Elev	Policy Flood Elev	Flood Proof Elev	Reloc- ation Elev	Start Damage Elev	Damage Elev Incr	Print Option Flag	Sampling Functn Flag
DR1	494.50	.00	.00	.00	485.00	1.00	0	0
DR2	503.60	.00	.00	.00	498.00	1.00	0	0

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Single Events for Damage Reaches

Damage Reach	2 YEAR EVENT	5 YEAR EVENT	10 YEAR EVENT	20 YEAR EVENT	50 YEAR EVENT	100 YEAR EVENT	500 YEAR EVENT
DR1	485.30	490.20	492.30	493.50	494.50	495.50	496.30
DR2	495.30	498.80	500.60	502.60	503.60	507.70	508.10

→ *(13) Titles of flood events*

→ *(14) Water surface elevations of single flood events by damage reach.*

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Structure I.D.= APT01 Ref. flood elev.= 493.00
13 APARTMENTS (1SWB) Structure reference elevation = 494.80
Damage reach DR1 Reference elev. at index = 496.30
Damage category APARTMTS

	First Floor			Basement			
	Structure	Content	Other	Structure	Content	Other	Total
Total Value	780000.	281000.	0.	625000.	225000.	0.	1911000.
Damage function	HR5	HR6		HR7	HR8		

Stage	Index Elev	First Floor Structure	First Floor Content	First Floor Other	Basement Structure	Basement Content	Basement Other	Total Total
-10.00	486.30	0.	0.	0.	0.	0.	0.	0.
-9.50	486.80	0.	0.	0.	12500.	6750.	0.	19250.
-9.00	487.30	0.	0.	0.	25000.	13500.	0.	38500.
-8.50	487.80	0.	0.	0.	40625.	19125.	0.	59750.
-8.00	488.30	0.	0.	0.	56250.	24750.	0.	81000.
-7.50	488.80	0.	0.	0.	78125.	33750.	0.	111875.
-7.00	489.30	0.	0.	0.	100000.	42750.	0.	142750.
-6.50	489.80	0.	0.	0.	134375.	57375.	0.	191750.
-6.00	490.30	0.	0.	0.	168750.	72000.	0.	240750.
-5.50	490.80	0.	0.	0.	206250.	88875.	0.	295125.
-5.00	491.30	0.	0.	0.	243750.	105750.	0.	349500.
-4.50	491.80	0.	0.	0.	281250.	113625.	0.	394875.
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.
-3.50	492.80	0.	0.	0.	362500.	129375.	0.	491875.
-3.00	493.30	0.	0.	0.	406250.	137250.	0.	543500.
-2.50	493.80	0.	0.	0.	434375.	151875.	0.	586250.
-2.00	494.30	0.	0.	0.	462500.	166500.	0.	629000.
-1.50	494.80	0.	0.	0.	490625.	181125.	0.	671750.
-1.00	495.30	0.	0.	0.	518750.	195750.	0.	714500.
-.50	495.80	0.	0.	0.	543750.	210375.	0.	754125.
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.
.50	496.80	3900.	5620.	0.	568750.	225000.	0.	803270.
1.00	497.30	7800.	11240.	0.	568750.	225000.	0.	812790.
1.50	497.80	35100.	37935.	0.	568750.	225000.	0.	866785.
2.00	498.30	62400.	64630.	0.	568750.	225000.	0.	920780.
2.50	498.80	85800.	77275.	0.	568750.	225000.	0.	956825.
3.00	499.30	109200.	89920.	0.	568750.	225000.	0.	992870.

(15) Structure and damage reach data

(16) Dollar value of structure

(17) Stage-damage function I.D. used

3.50	499.80	124800.	98350.	0.	568750.	225000.	0.	1016900.			
4.00	500.30	140400.	106780.	0.	568750.	225000.	0.	1040930.			
4.50	500.80	156000.	116615.	0.	568750.	225000.	0.	1066365.			
5.00	501.30	171600.	126450.	0.	568750.	225000.	0.	1091800.			
5.50	501.80	183300.	133475.	0.	568750.	225000.	0.	1110525.			
6.00	502.30	195000.	140500.	0.	568750.	225000.	0.	1129250.			
6.50	502.80	206700.	144715.	0.	568750.	225000.	0.	1145165.			
2 YEAR											
-11.00	485.30	0.	0.	0.	0.	0.	0.	0.			
5 YEAR											
-6.10	490.20	0.	0.	0.	161877.	69076.	0.	230952.			
10 YEAR											
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.			
20 YEAR											
-2.80	493.50	0.	0.	0.	417501.	143100.	0.	560601.			
50 YEAR											
-1.80	494.50	0.	0.	0.	473751.	172350.	0.	646101.			
100 YEAR											
-.80	495.50	0.	0.	0.	528751.	201600.	0.	730351.			
500 YEAR											
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.			

(27) Dollar damage value of single flood events.

Damage was not calculated for entire stage damage function for Structure.
Damage was not calculated above maximum elevation for damage reach.

Basement damage functions were adjusted -10.0 feet to reflect the
difference between the first floor and basement elevations (DELTB).

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Trace for damage category APARTMTS in damage reach DR1

Structure Identification	APT01		
REFFLD at index station	494.50	REFFLD at structure	493.00
Policy elevation	.00	Structure Topo	494.80
Flood proof elevation	.00	Topo at index station	496.30
Relocation elevation	.00	Topo after policy action	496.30

(28) Trace printout as specified on the J7 record.

(29) Structure and reach data.

Flood Stage	Flood Elev	Damage	Accum Damage
-10.30	486.00	0.	0.
-9.30	487.00	26950.	27.
-8.30	488.00	68251.	68.
-7.30	489.00	124226.	124.
-6.30	490.00	211351.	211.
-5.30	491.00	316876.	317.
-4.30	492.00	413026.	413.
-3.30	493.00	512526.	513.
-2.30	494.00	603351.	603.
-1.30	495.00	688851.	689.
-.30	496.00	769976.	770.
.70	497.00	807078.	807.
1.70	498.00	888384.	888.
2.70	499.00	971244.	971.
3.70	500.00	1026513.	1027.
4.70	501.00	1076540.	1077.
5.70	502.00	1118016.	1118.

(30) Elevation-damage values

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1

There were no modifications to any buildings in this damage reach ——→ *(31) Define nonstructural modifications made to structures in reach DR1.*

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1 ——————→ *(32) Damage reach identification*

Number of Structures in Flood Zones ——————→ *(33) Damage reach identification*
(Based on First Floor Elevations)

Flood Zone

Dmg Cat	Zero TO 2 YEAR	2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO 100 YEAR	100 YEAR TO 500 YEAR	ABOVEMAX					Total
MOBL HOM	0	0	1	0	1	1	0	0	0	0	0	0	3
APARTMTS	0	0	0	0	1	0	1	0	0	0	0	0	2
Total	0	0	1	0	2	1	1	0	0	0	0	0	5

Number of Structures in Flood Zones

(Based on Zero Damage Elevations)

(34) Number of structures by category based on zero damage elevations.

Flood Zone

Dmg Cat	Zero TO 2 YEAR	2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO 100 YEAR	100 YEAR TO 500 YEAR	ABOVEMAX					Total
MOBL HOM	0	0	1	1	1	0	0	0	0	0	0	0	3
APARTMTS	0	1	0	0	1	0	0	0	0	0	0	0	2
Total	0	1	1	1	2	0	0	0	0	0	0	0	5

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
Structural Value Flood Zone Summary
(at first floor elevation)
value is in $1,000

(35) *Structure associated values by flood zones based on first floor elevations.*

	Flood Zone											
Dmg Cat	Zero TO *2 YEAR	*2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO *100 YEAR	100 YEAR TO *500 YEAR	*ABOVEMAX				Total
MOBL HOM	.0	.0	20.0	.0	27.0	35.0	.0	.0	.0	.0	.0	82.0
APARTMTS	.0	.0	.0	.0	1205.0	.0	1911.0	.0	.0	.0	.0	3116.0
Total	.0	.0	20.0	.0	1232.0	35.0	1911.0	.0	.0	.0	.0	3198.0

TEST 1 - OUTPUT DISPLAY
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
DRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
(Damages are in $1,000)

Damage Categories

(36) *Damage reach identification and title.*

(37) *Elevation-damage functions by categories.*

Elevation	MOBL HOM	APARTMTS	S.F.RES.	COMMERCL	OTHER					Total
485.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
486.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
487.00	.0	27.0	.0	.0	.0	.0	.0	.0	.0	27.0
488.00	.0	68.3	.0	.0	.0	.0	.0	.0	.0	68.3
489.00	.0	124.2	.0	.0	.0	.0	.0	.0	.0	124.2
490.00	.0	211.4	.0	.0	.0	.0	.0	.0	.0	211.4
491.00	.0	316.9	.0	.0	.0	.0	.0	.0	.0	316.9
492.00	1.1	413.0	.0	.0	.0	.0	.0	.0	.0	414.1
493.00	7.5	512.5	.0	.0	.0	.0	.0	.0	.0	520.0
494.00	14.4	603.4	.0	.0	.0	.0	.0	.0	.0	617.7
495.00	29.8	710.7	.0	.0	.0	.0	.0	.0	.0	740.5
496.00	50.4	915.1	.0	.0	.0	.0	.0	.0	.0	965.5
497.00	62.2	1034.3	.0	.0	.0	.0	.0	.0	.0	1096.5
498.00	68.5	1170.3	.0	.0	.0	.0	.0	.0	.0	1238.8
499.00	71.4	1311.1	.0	.0	.0	.0	.0	.0	.0	1382.5
500.00	73.1	1409.0	.0	.0	.0	.0	.0	.0	.0	1482.1
501.00	74.0	1495.2	.0	.0	.0	.0	.0	.0	.0	1569.1
502.00	74.2	1552.0	.0	.0	.0	.0	.0	.0	.0	1626.2

(38) Summary of single event damage values by damage categories.

(2 YEAR)											
485.30	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
(5 YEAR)											
490.20	.0	231.0	.0	.0	.0	.0	.0	.0	.0	.0	231.0
(10 YEAR)											
492.30	2.1	440.3	.0	.0	.0	.0	.0	.0	.0	.0	442.4
(20 YEAR)											
493.50	11.2	560.6	.0	.0	.0	.0	.0	.0	.0	.0	571.8
(50 YEAR)											
494.50	22.3	657.0	.0	.0	.0	.0	.0	.0	.0	.0	679.3
(100 YEAR)											
495.50	40.2	813.8	.0	.0	.0	.0	.0	.0	.0	.0	854.1
(500 YEAR)											
496.30	54.0	963.5	.0	.0	.0	.0	.0	.0	.0	.0	1017.5

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category COMMERCL identified as COMMERCIAL
Damage category OTHER identified as OTHER DAMAGE CATEGORIES

Sample Problems

Sample problems illustrating various types of calculation capabilities of the SID program are included in Appendix D. The sample input and output will provide the user with an overall description of the data necessary for the program. The problems also provide a valid data verification set to assure proper program operations on other computer systems.

References

Burnham, Michael W., 1985. "Engineering and Economic Considerations in Formulating Nonstructural Plans," Technical Paper-103. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

Carl, Robert D. and Davis, Darryl W., 1988. "An Integrated Software Package For Flood Damage Analysis", Technical Paper. Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, CA.

Corps of Engineers, U. S. Army, 1975. "Phase 1 Oconee Basin Pilot Study, Trail Creek Test", Hydrologic Engineering Center, Davis, CA.

_____, 1979. "Damage Reach Stage-Damage Calculation (DAMCAL) User's Manual" U.S. Army Corps of Engineers, Davis, CA.

_____, 1981. "Data Management Systems for Water Resources Planning." Technical Paper-81. Hydrologic Engineering Center, Davis, CA.

_____, 1982. "Simulation of Flood Control and Conservation Systems (HEC-5) User's Manual". Hydrologic Engineering Center, Davis, CA.

_____, 1983. "Structure Inventory For Damage Analysis Edit Program (SIDEDT) User's Manual". Hydrologic Engineering Center, Davis, CA.

_____, 1984. "Expected Annual Flood Damage Computation (EAD) User's Manual". Hydrologic Engineering Center, Davis, CA.

_____, 1987. "Flood Hydrograph Package (HEC-1) User's Manual." Hydrologic Engineering Center, Davis, CA.

_____, 1987. "HECDSS User's Guide and Utility Program Manuals." Hydrologic Engineering Center, Davis, CA.

_____, 1988. "Flood-Damage Analysis Package," Training Document-21. Hydrologic Engineering Center, Davis, CA.

_____, 1988. "Flood Damage Analysis Package On The Microcomputer, Installation and User's Guide". Hydrologic Engineering Center, Davis, CA.

Davis, Darryl W., 1974. "Optimal Sizing of Urban Flood Control Systems," paper presented at Seminar on Analytical Methods in Planning, March 26-28, 1974, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

_____, 1975. "Analytical Tools in Planning Nonstructural Measures," (Paper delivered at Nonstructural Flood Management seminar 4-6 May 1976, Fort Belvoir, Virginia). The Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

_____, 1978. "Comprehensive Flood Plan Studies Using Spatial Data Management Techniques," paper published in Water Resources Bulletin. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

_____, 1980. "Flood Mitigation Planning Using HEC-SAM," Technical Paper-73. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

Davis, Darryl W. and Webb, R. Pat, 1978. "Flood Damage Assessments Using Spatial Data Management Techniques," Technical Paper-57. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

Ford, David T. and Davis, Darryl W., 1983. "Hydrologic Engineering Center Planning Models," Technical Paper-92. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

Johnson, William K. and Davis, Darryl W. 1984. "The Hydrologic Engineering Center Experience in Nonstructural Planning," Technical Paper-96. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

Water Resources Council 1979. "Procedures for Evaluation of National Economic Development Benefits and Costs in Water Resources Planning (Level C); Final Rule," Federal Register, Part IX.

Webb, R. Pat and Michael W. Burnham 1976. "Spatial Data Analysis of Non-structural Measures," Technical Paper-46, Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, CA.

APPENDIX A

Glossary of Input Variables

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
ADDR	SA.5 - SA.7	Street address of structure
ADJ	SL.5	Elevation of the reference flood at the structure
AGG	J2.4	Elevation tabulation interval to be used in construction of elevation-damage functions
ALT	ZW.3 - ZW.5	HECDSS alternative pathname label (Part F)
BC	SS.5 (35-36)	Code for basement construction type
BG	SS.4 (29-30)	Code for presence of basement
BSIZE	SS.5 (37-40)	Basement area
BT	SS.5 (33-34)	Categorization of basement type
CG	SS.4 (25-26)	Categorization of construction type
CITY	SA.8 - SA.9	City where structure is located
COLE	SL.4	Column or East coordinate point of structure
DELTB	SL.8	Difference between elevation of basement floor and structure reference point elevation
DELTG	SL.9	Difference between the elevation of the ground and structure reference point elevation
DELTZ	SL.7	Difference between water surface elevation where damage can begin and reference point elevation
DEPRF	J7.4, J7.7, J7.10	Height of flood proofing for the structure relative to the zero damage point
DPRF	J.6	Height of flood proofing for damage category in relation to zero damage point
DTITLE	DT	Title and/or description of damage reach
ELINTR	DR.7	Elevation tabulation increment at which damage potential will be computed, printed and stored
EVCELV	DR.5	Target water surface elevation at index location for structure relocation
FC	SS.8 (59-60)	Code for first floor construction type
FSIZE	SS.8 (61-64)	First floor area
IADDR	SD.7 - SD.10	Space allowed for comment/record keeping
IAG	J1.9	Specification for aggregation of single event damage results

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
IAGGDC	AC	Aggregated new damage category in which the damage for the associated damage categories is placed
IBLDG	SL.2, SD.2, SO.2, SS.2, SA.2	Structure identification code
IDAC	SO.7 (49-51)	Identification code for damage potential function to be assigned for damage to the contents above first floor
IDAO	SO.8 (57-59)	Identification code for damage potential function to be assigned for damage to "other" items above first floor
IDAD	SO.6 (41-43)	Identification code for damage potential function to be assigned for damage to the structural portion above first floor
IDBC	SO.4 (25-27)	Identification code for damage potential function to be assigned for damage to contents of the basement
IDBO	SO.5 (33-35)	Identification code for damage potential function to be assigned for damage to "other" items of the basement
IDBS	SO.3 (17-19)	Identification code for damage potential function to be assigned for damage to the structural portion of the basement
IDCAT	SD.3	Damage category to which structure will be assigned for consolidation of damage potential for all structures
IDF	DF.3	Identifies damage potential function as stage-percent damage or stage-direct dollar damage
IDFILE	DF.4	Identifies location of damage potential function depth and damage data
IDPRT	DR.8	Damage reach structure information print option
IDRCH	SL.1, SD.1, SO.1, SS.1, SA.1	Damage reach identification code
ID1FC	SD.5 (33-35)	Identification code for damage potential function to be assigned for damage to contents of the first floor or composite structure
ID1FO	SD.4 (41-43)	Identification code for damage potential function to be assigned for damage to "other" of the first floor or composite structure
ID1FS	SD.4 (25-27)	Identification code for damage potential function to be assigned for damage to the structural portion of the first floor or composite structure
IDF3	DR.9	Flag for damage reach to indicate whether sample scaling is desired
IELV	J2.7	The number of elevation tabulation values to be used in development of the elevation- damage relationships

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
IEVAC	J1.3	Indicates the type of relocation action to be used
IFUNC	SL.10 (73-74)	Indicates amount of additional information on structure
IMAGE	J2.6	Controls listing and record image printout as the records are read
IMARK	J2.8	Indicates the value to be used for the structure for the value structural flood zone summary
IOA	OA	Establishes the priority order in which the several measures for flood proofing, raising-to-target, and relocation are considered for analysis
IOACRD	J1.4	Indicates whether the order of evaluation options will be specified
IPOL	J1.1	Indicates the type of raising-to-target action to be used
IPRNT	J1.5	Controls the print options
IPROF	J1.2	Indicates the type of flood proofing action to be used
ISAMP	J1.10	Indicates if sample scaling is desired
IT	DF.1	Damage potential function identification code
ITDC	TR.3	Damage category to be traced
ITDR	TR.2	Damage reach to be traced
ITRACE	J1.6	Indicates whether trace output providing detailed results of specified analysis is desired
ITYPE	J1.8	Number of single flood event damage values to be calculated
IZIP	SA.10	Zip code for structure
JDCT	DC.2	Identifier for the category into which individual structure damage potential will be consolidated for summary printout and computer file transfers
JDR	DR.1	Damage reach identification code
JEVAC	J8	Damage category identification code to be subjected to relocation analysis
JPOL	J3	Damage category identification code to be subjected to raise-to-target elevation analysis
JPRF	J5	Damage category identification code to be subjected to flood proofing analysis

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
KODE	field 0 all records	Record identification code
MDCT	TM.2, TM.4, TM.6, TM.8, TM.10	Identification codes for damage categories to be traced
MDRT	TM.1, TM.3, TM.5, TM.7, TM.9	Identification codes for damage reaches to be traced
MTRACE	TR.5	Number of damage reach - damage category combinations to be traced
NAGGDC	AC.1	Number of aggregated new damage categories
NAGGDR	AR.1	Number of aggregated new damage reaches
NDFILE	J2.9	Location of damage potential function data
NEWSTR	SL.10 (75)	Identifies the structure as existing or new for analysis purposes
NFILE	J2.5	Location of structure information data
NG	SS.4 (27-28)	Code for number of floors not including basement
NJEVAC	J8.1	Number of damage categories subject to relocation analysis
NJPOL	J3.1	Number of damage categories subject to raise-to-target elevation analysis
NJPROF	J5.1	Number of damage categories subject to flood proofing analysis
NOB	SS.7 (49-50)	Number of "other" openings below the first floor
NODC	J2.2	Number of damage categories
NODF	J2.1	Number of damage functions
NODR	J2.3	Number of damage reaches
NOF	SS.10 (73-74)	Number of "other" openings above first floor elevation
NSTAG	DR.2	Number of depth tabulation values for damage function
NSTR	J4.1, J7.1, J9.1	Number of structures to be subjected to non-structural analysis
NSTRS	TR.4	Number of structures to be traced
NTRACE	TR.1	Identifies what is to be traced
NWB	SS.6 (41-42)	Number of windows below the first floor

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
NWF	SS.9 (65-66)	Number of windows in the first floor
OAD	SS.7 (51-53)	Average size of "other" openings below first floor
OAS	SS.10 (75-77)	Average size of "other" openings above first floor elevation
OBF	SS.7 (54-56)	Elevation difference between the lowest "other" opening and the first floor reference point
ODF	SS.10 (78-80)	Elevation difference between the lowest "other" openings above first floor and the first floor reference elevation
PERCNT	PC or DD	Percent or direct damage values for damage function
POLELV	DR.3	Target water surface elevation at the index location for raise-to-target analysis
POLMAX	DC.3	Maximum feasible amount structures of this damage category could be raised
PRFMAX	DC.4	Maximum feasible amount structures of this damage category could be flood proofed
PROELV	DR.4	Target water surface elevation at index location for flood proof to target flood level analysis
PROJ	ZW.1, ZW.2	HECDSS Project pathname label (Part A)
REFFLD	DR.2	Elevation of the reference flood at the index location
RESID	SA.3, SA.4	Name of resident or business
ROWN	SL.3	Row or North coordinate value of structure
SAGE	DP	Depth values for damage functions
SAMPLE	D3	Percent of structures sampled within associated damage category
SEVTIT	ST	Title for single flood events
SF	SS.3 (21-22)	Soil foundation type
SINGLE	SE	Water surface elevations at index locations for single flood events
STOPO	SC.6	Structure reference elevation
STRELV	DR.6	Starting water surface tabulation elevation for elevation-damage function development
STREVC	J9	Structure identification code for structures subject to relocation analysis

Glossary of Input Variables

Variable	Record.Field (columns)	Variable Definition
STRPOL	J4	Structure identification code for structures subject to raise-to-target analysis
STRPRF	J7	Structure identification code for structures subject to flood proofing analysis
STRTRC	TS	Structure identification code for structures to be traced
TG	SS.3 (23-24)	Categorization of structure type
TITDC	DC.5 - DC.10	Title to be associated with damage category identification
TITLE	T1, T2, T3	Title information for computer run
TYPRF	J7	Type of flood proofing analysis for structure
VAC	SO.7 (52-56)	Value of contents above first floor
VAO	SO.8 (60-64)	Value of "other" above first floor
VAS	SO.6 (44-48)	Value of structural portion above the first floor
VBC	SO.4 (28-32)	Value of contents of the basement
VBO	SO.5 (36-40)	Value of "other" items of basement
VBS	SO.3 (20-24)	Value of structural portion of basement
V1FC	SD.5 (36-40)	Value of contents of first floor or composite structure
V1FO	SD.6 (44-48)	Value of "other" items of first floor or composite structure
V1FS	SD.4 (28-32)	Value of structure of first floor or composite structure
WAB	SS.5 (43-45)	Average size of window openings below the first floor
WAF	SS.9 (67-69)	Average size of window openings on the first floor
WBF	SS.6 (46-48)	Elevation difference between lowest window below first floor and the first floor reference point
WDF	SS.9 (70-72)	Elevation difference between lowest window above the first floor elevation and the first floor reference point elevation
YC	SS.3 (17-20)	Year of completion of structure

APPENDIX B

Field Survey and Inventory Procedures

Field Survey and Inventory Procedures

Overview

Field reconnaissance and surveys are performed to inventory structure data used in estimating the flood damage potential of an area. The information and extensiveness of the field surveys vary with study requirements and resource availability. For some investigations, inventories of representative sampled areas are used to project existing or future development characteristics of the entire area for subsequent estimate of the associated damage potential. Other investigations are performed using inventoried data developed from a complete survey of all structures within the flood plain in the study area. The accuracy and scope of the field surveys and level of detail requirements are dependent upon the nature of the investigation and detail required for commensurate hydrologic and hydraulic evaluations.

Structure Inventory Information Requirements

The structure inventory process requires considerable forethought and initial preparation prior to actual information gathering. Information needs and the degree of detail required must be considered prior to inventory gathering and field surveys. Appropriate documentation and referencing of data for the present and future investigations must also be considered.

A list of the information needs pertinent to analysis of individual structures is provided below. The data may be compiled from previous studies, cartographic data (i.e., aerial photographs, topographic elevations), and general field reconnaissance or detailed field surveys. Typical structure data requirements are as follows:

- Structure identification - identification number, code, or label of the structure;
- Structure location - coordinates, street address, zip codes, damage reach;
- Type of structure - single or multistory, with or without basements, etc.;
- Reference elevation of structure - either ground or first floor;
- Reference flood elevation of structure - the elevation of the designated flood profile for each structure;
- Value of the structure, contents, and other items; and
- Appropriate stage-damage functions for the structure, contents, and other items.

Other structure attributes and information may be beneficial in evaluating the damage potential and physical feasibility of implementing nonstructural measures at the structure. These include the number and type of openings, foundation type, construction materials, and square footage of the structure.

Structure Inventory Procedures

The procedures adopted to generate and develop structure inventory information for assessments of the flood damage potential of the area vary with the requirements needs, resources, and experience of the analyst. An example of what might be termed a "typical" procedure for performing a structure inventory data is provided below.

Preliminary Assessments

This phase would include a review of previous study data and procedures of similar scope and requirements, delineation of the area to be investigated, and an initial reconnaissance of the area to determine the nature of the flood threat and damage potential.

Structure Identification

This aspect includes locating and establishing identification codes of existing structures using such criteria and methods as a coordinate system, street addresses, aerial photographs, etc.

Structure Reference Elevations

Estimates of structure reference elevations and reference flood elevations at the structures should be obtained from cartographic data or field survey. Reference flood elevation assignments may be obtained from reference flood inundation boundary maps and water surface profiles as provided from hydraulic analyses. Structure reference elevations may be obtained using topographic maps and aerial photographs.

Stage-Damage Data

General stage-damage functions should be developed or adopted for the selected types of residential, commercial, industrial, and other structures. Occasionally detailed structure damage potential assessment is developed from entering structures and cataloging the structural features and contents. This is done most often to verify an existing damage function or provide basic data to create a new one or modify an existing one. Damage categories to be used in the analysis would also be adopted at this stage.

Future Conditions

Scenarios and projected future development patterns should be obtained from pertinent agency resources if possible. The nature, location, and types of structures should be estimated. The "most probable future" and other future alternative development patterns should be identified.

Alternative Measures

Identify potential alternative flood mitigation measures to be analyzed.

Field Surveys

Detailed field surveys should be conducted to verify reference elevations, estimate value assignments of structures, and select appropriate stage-damage functions. Structure reference elevations (first floor or ground levels) may be obtained via detailed topographic maps (field verified), hand levels, or surveying in the field using survey instruments. Structure value assignments may be determined by use of field reconnaissance, interviews, real estate listings, etc. Unique structures (historic buildings, industrial, and commercial establishments) may require development of direct (actual) stage-damage functions.

The structure survey field data form located on the next page is a suggested format to assist in field inventory and documentation of structure data requirements for specification to the SID program. The data collected via this form may be used to directly encode the SL, SD, SO, SS, and SA record data associated with the individual structures.

Study: _____

Date: _____

Prepared by: _____

Structure Survey Field Form

Resident: _____

Address: _____

City: _____

Zip: _____

River mile: _____

Building ID (IBLDG): _____

Damage Reach (IDRCH): _____

Damage Category (IDCAT): _____

Ref Flood Elev (ADJ): _____

Structure Ref Elev (STOPO): _____

Coordinates: North (ROWN): _____

East (COLE): _____

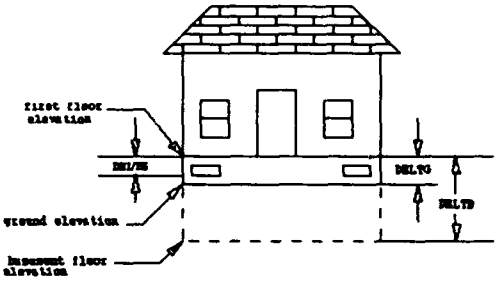
Zero Damage Elev-FF (DELTZ): _____

Basement-First Floor (DELTB): _____

First Floor-STOPO (DELTG): _____

Location	Damage Type	Value	Damage Fraction
Above First Floor	Structure (IDAS)		
	Contents (IDAC)		
	Other (IDAO)		
First Floor	Structure (IDAS)		
	Contents (IDAC)		
	Other (IDAO)		
Basement	Structure (IDAS)		
	Contents (IDAC)		
	Other (IDAO)		

Remarks: _____



DATA RECORDS

1	2	3	4	5	6	7	8	9	10
1 3 3 4 5 6 7 8	9 10 11 12 13 14 15 16	17 18 19 20 21 22 23 24	25 26 27 28 29 30 31 32	33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48	49 50 51 52 53 54 55 56	57 58 59 60 61 62 63 64	65 66 67 68 69 70 71 72	73 74 75 76 77 78 79 80
ID IDRCH	IBLDG	ROWN	COLE	ADJ	STOPO	DELTZ	DELTB	DELTG	
SI									
ID IDRCH	IBLDG	IDCAT	ID1FS	V1FS	ID1FC	V1FC	ID1FO	V1FO	IADDR
SD									
ID IDRCH	IBLDG	IDBS	VBS	IDBC	VBC	IDBO	VBO	IDAS	VAS	IDAC	VAC	IDAO	VAO	RVHILE	STOIDX
SO									
ID IDRCH	IBLDG	YC	SF	TG	CG	FG	BG	ST	BC	BS	IZB	FVB	VAB	VBF	BOB	OAB	OBF	FC	FSIZE	B	K	BAF	VBF	BO7	OAF	OBF
SS																										
ID IDRCH	IBLDG	RESID	ADDR	CITY	IZIP
SA					

APPENDIX C

Data Management Concepts and Procedures

Data Management Concepts and Procedures

Introduction

Data management, a combination of information processing, storage, and retrieval, is an integral part of performing expedient and consistent water resource investigations. Several data management features and capabilities have been incorporated in the SID program to assist the user in evaluating the damage potential of structures in the flood plain. These features enable user flexibility in managing input data to the program and the output data format so as to be compatible with subsequent input and evaluation capabilities of other programs. Consequently, the user must have as a minimum a conceptual understanding of data management procedures and requirements.

Data management centers about manipulation of structural input data, damage function input data, and subsequent processing of the results of the program (see Section II, Flood Damage Analysis and Information Processing). The options are based on the use of sequential or direct access data files. The file format and computer system requirements and operations have been made transparent to the user to the extent possible.

Basic Terminology

There are three types of data input devices for a computer program:

- Keyboard
- Magnetic tape
- Magnetic disk

Output may be on magnetic tape, disk, or via printer device. A collection of data on any of the devices is called a file (disk file, tape file, etc.). The keyboard input and simple tape files are inherently sequential files, requiring all preceding data on the file to be read in a sequential manner before reaching the desired data. Disk files may be either sequential or direct access. A direct access file, which always resides on a magnetic disk, allows access to any record within a file based on a labeling hierarchy (key data fields such as pathname) used to locate and identify the record. Figure 13 depicts the concepts of data retrieval from sequential and direct access files.

SID program input may be via either sequential or direct access files. A sequential file is processed by always beginning at the initial data record and processing through the records in sequence until the desired information is obtained. In the past, the most common sequential file was punched cards; but now the files will usually consist of data records residing on magnetic disk. Sequential file processing is generally easier to program and develop but requires more data retrieval time than processing direct access files.

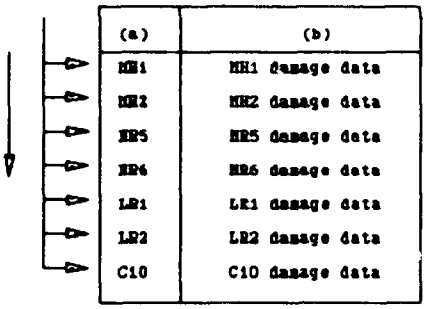
Direct access files are developed using a hierarchy of key data items which enables the program to logically search through the data file until the desired information is located. Direct access files are typically more difficult to initially develop and program but are more efficient than sequential files in locating information contained in large data files.

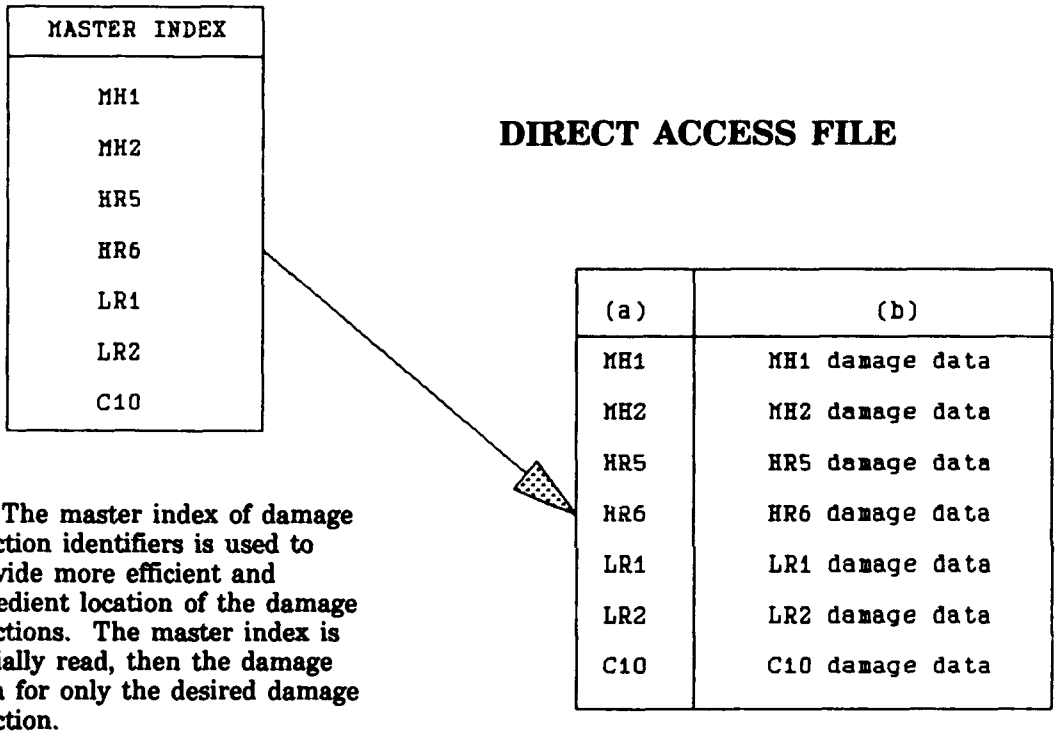
Recent emphasis in computer data processing is towards the use of disk files with magnetic tape files used primarily for disk file back-up. Files referenced in the following examples as File11, File12, File13 ... Filen, generally reside on a magnetic disk file instead of tape. The user must know the data file names used in developing the job control language (JCL) to execute the SID program.

Figure 13: Sequential and Direct Access Data File Concepts

SEQUENTIAL DATA FILE

To retrieve data for an individual damage function, each record must be read until the desired function is located. For example, to obtain the damage function data for the residential damage function (LR1), the data must be read for the following damage functions: MH1, MH2, HR5, and HR6. If the requested damage function is C10, then the entire file must be read beginning at MH1.





The master index of damage function identifiers is used to provide more efficient and expedient location of the damage functions. The master index is initially read, then the damage data for only the desired damage function.

Structure Data Input Options

Data management input options for structure data include only the use of sequential files. For relatively small numbers of structures, the structure data may be included with the other SID input data. For large numbers of structures, the structure data should be stored in a separate sequential file to enable editing and updating of the files using a text editor or the SIDEDT program. Information stored in the structure files include the data fields on the SL, SD and optional SO, SS, and SA records. These requirements include the structure and reach identification codes, reference flood elevation at the structure, damage category, value of structure and contents, etc. Figure 14 illustrates and defines user options for managing structure inventory data on sequential files. Subsequent paragraphs explain the definition of the options and lists the JCL required to execute the program.

Option A
SID Input Data File

The entire input stream of SID input data including structural data depicted in Figure 14 resides in one sequential file. The user must specify data variable NFILE (J2.5) as a blank or zero. Example JCL for execution of the SID program with all data input in one file is:

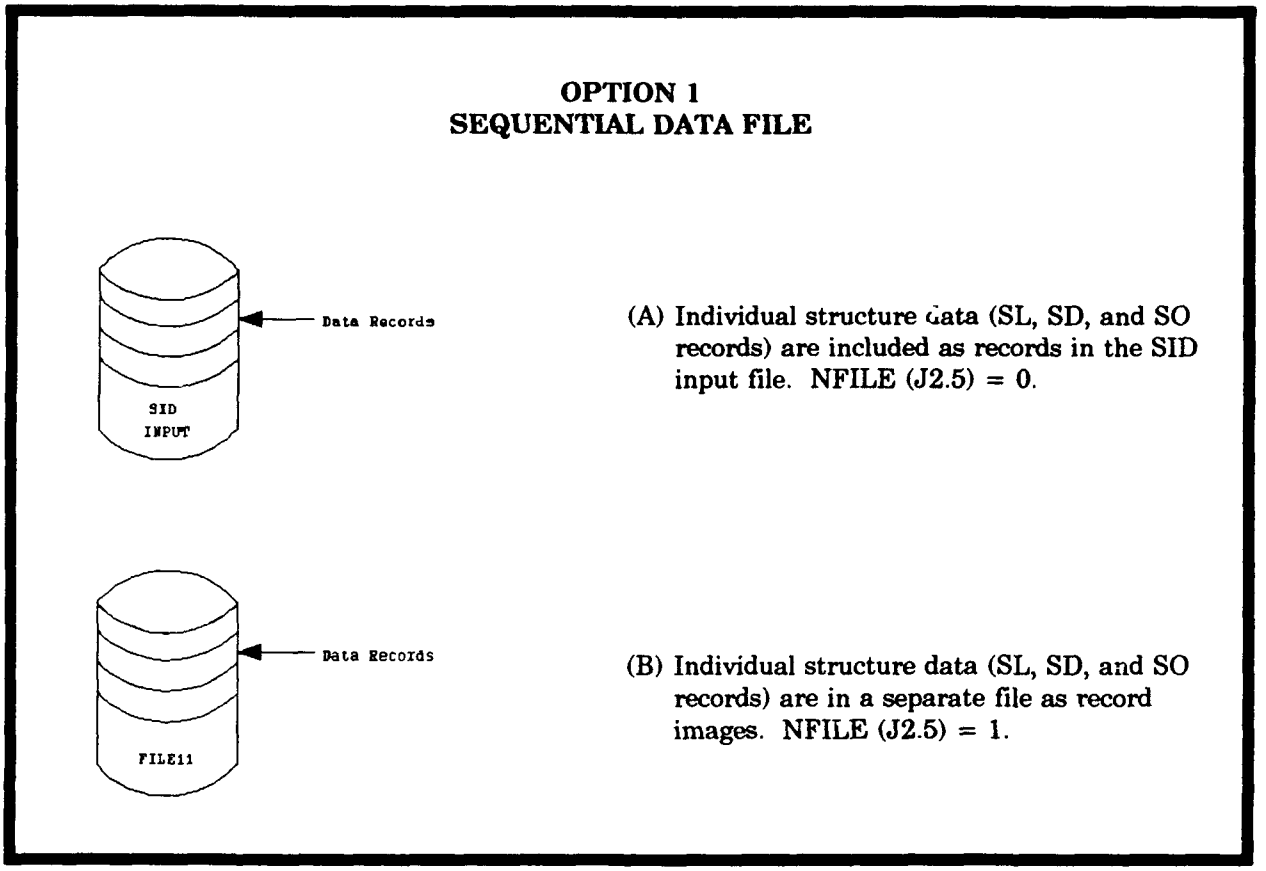
SID, I=(SID Input Data File)

Option B
Sequential File

Structural data may be defined in a separate sequential file for large numbers of structures in order to minimize the data management task. Additional structures (more than in the sequential file) may be evaluated by including the appropriate input data records for the structures with the remainder of the SID input data. Data variable NFILE (J2.5) must equal 1 for this option signifying that the structure data resides on unit FILE11. An ES record must be the last record of the sequential file and also the last record in the SID input data file.

SID,I=(SID input data file),S=(Structure Sequential File)

Figure 14: Data File Options For Structure Inventory Data



Damage Function Input Options

Data management input options for stage-damage function data include both the use of sequential and direct access files. A maximum of fifty (50) functions comprised of structure, contents, and other damage types may be included in a sequential file either with the SID input data or in a separate sequential file. For investigations requiring more than 50 stage-damage functions, direct access files must be used. Figure 15 depicts the user options and key data variables required. The following paragraphs describe the various options, data variable specifications, and JCL.

Option 1A
SID Input Data File

Damage functions are commonly included with the SID input data because of the small number of functions (as compared to structures) normally required in the analysis. For this option, the number of damage functions, data variable NODF (J2.1), must be less than or equal to 50, and data variable NDFILE (J2.9) must equal zero or be left blank.

SID, INPUT = (SID Input Data File)

Option 1B
Sequential File

This option enables the user to define damage function data in a separate sequential file. This option is typically utilized when large numbers of damage functions are required for the analysis or when damage functions are used for various studies. There must be NODF (J2.1) sets of DF, DP and PC (or DD) records on this file. Damage function records are not included in the SID input data file. Data variable NDFILE (J2.9) must equal 2 signifying that the damage function file resides on unit FILE2 (JCL keyword DMGFUNC).

SID,INPUT=(SID Input Data File),D=(Damage Function Data File)

Option 2A
Direct Access File
DF Records

Direct access files of damage functions are required if more than 50 damage functions are needed to properly assess the damage potential of a study area. For this option the DF records are only included with the SID data input stream. Data variable IFILE (DF.4) must equal 1. The number of damage function sets, DF through DD records, must equal NODF (J2.1), and NDFILE (J2.9) must equal 98. The SIDEDT program must be used to create the direct access file FILE98 (keyword RANDMG).

SID,I=(Input Data File),R=(Direct Access Damage Function File)

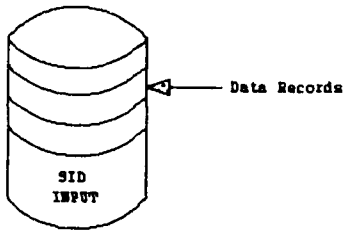
Option 2B
Direct Access File with DF Record Data on A Sequential File

This user option is identical to the previously described option of using a direct access file to process more than 50 damage functions except the DF record data are processed using a sequential file FILE92 (keyword DFRECS) instead of included in the SID input data. The DF records are not included in the SID input data stream. There must be NODF (J2.1) sets of damage function cards and data variable NDFILE (J2.9) must equal 92.

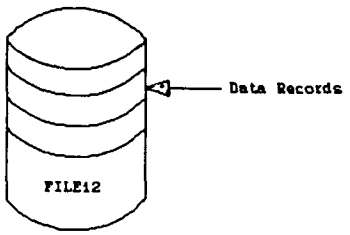
SID,I=(Input Data File),R=(Direct Access Damage Function File), D=(DF Record Sequential File)

Figure 15: Data File Options For Damage Function Data

OPTION 1
SEQUENTIAL DATA FILE

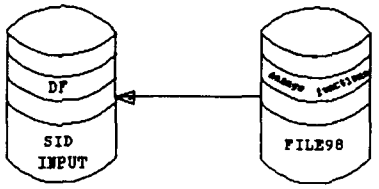


(A) Damage function data (DF, DP, PC (or DD) records) are included as records in the SID input file. NDFILE (J2.9) = 0.



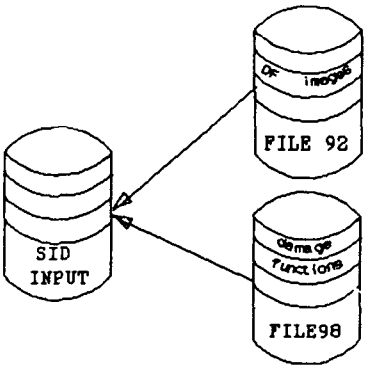
(B) Damage functions (DF, DP, PC (or DD) records) are in a separate file as record images. NDFILE (J2.9) = 2.

OPTION 2
DIRECT ACCESS DATA FILE



(A) DF records required in the SID input file. Damage function data to be input from direct access file, FILE98. NDFILE (J2.9) = 98.

OR



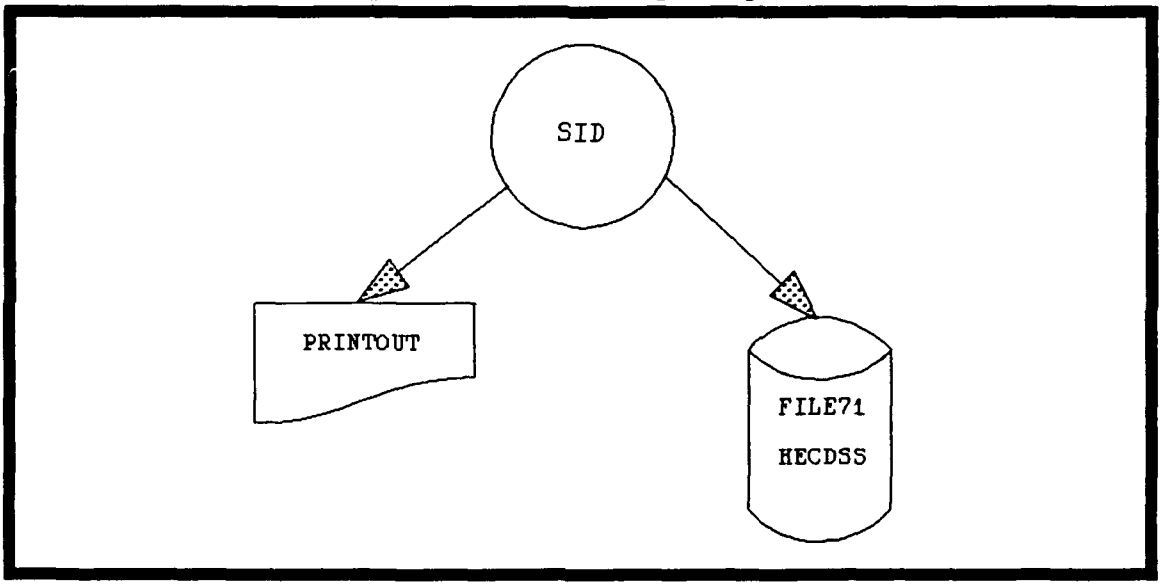
(B) Damage function data to be input from direct access file, FILE98. DF records are on sequential file, FILE92. NDFILE (J2.9) = 92.

Data Output Capabilities

Overview

Two output options are available in the SID program, printer output and output to a general purpose direct access file, HECDSS (previously described). The printer output may be used to review and verify specified input data and program operations as well as provide a display of the results. The printer output is automatic unless suppressed by the use of job control language. The HEC Data Storage System (HECDSS) provides the pathway to transfer the SID results (elevation-damage functions) to other computer programs for further analysis. The HECDSS is most applicable for flood damage analyses involving large numbers of structures, damage categories, and damage reaches. Figure 16 illustrates the two output options. The following paragraphs elaborate on the capabilities and requirements associated with utilizing the HECDSS.

Figure 16: SID Output Options

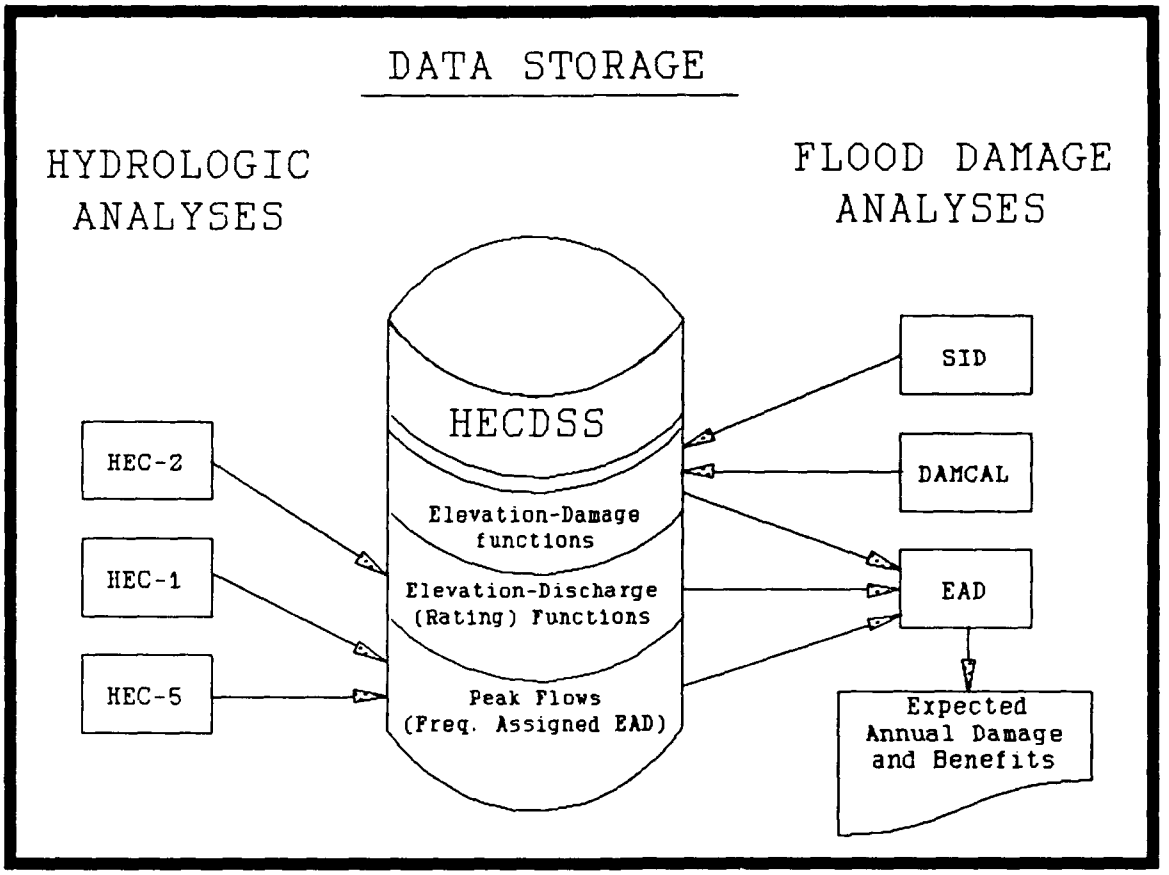


HEC Data Storage System

The HEC Data Storage System (HECDSS) is a software system which enables the automatic interface of analysis programs via exchange of information (input-output) through use of a direct access disk file. The output storage and retrieval of data utilizes a unique classification scheme, termed "pathname", for each data set. Application of HECDSS is designed to minimize the effort of the user in manipulating and processing information, provide enhanced data management capabilities in an ordered manner, and expedite the evaluation process.

An example of the utilization of the HECDSS in performing flood damage assessments is depicted in Figure 17. (A comprehensive example may be found in the HEC Training Document-21, "Flood-Damage Analysis Package.") Analyses for runoff hydrographs (HEC-1, with frequency assigned in EAD), rating functions (HEC-2), and elevation-damage functions (SID) are specified for automatic output to the HECDSS. These data are subsequently accessed by the Expected Annual Damage (EAD) program to perform evaluations of expected annual damage and inundation reduction benefits. The entire process may be performed in stages by the various disciplines (normal case for verification process) or performed sequentially as a single execution specified by the job control language.

Figure 17: Schematic of Flood Damage Analysis Package



Pathname Concept

The HEC Data Storage System makes use of a "pathname" to establish the hierarchy of the direct access file. The pathname consists of a unique hierarchical labeling scheme for each data set. Information stored in HECDSS by an analysis program using a specific pathname may be assessed by a different program using the same pathname. Figure 18 depicts this concept using the SID program requirements. In this schematic, five levels of the pathname are required to uniquely define the elevation-damage functions for each damage reach. They are as follows:

(A) The project name (James River).
(B) The location name (Damage Reach 10).
(C) The variable (elevation-damage function).
(D) Not used.
(E) Input data year (2000).
(F) The alternative name (flood proof plan B).

For this example, the pathname may be written as:

/Project name/Location/Variable//Data Year/Alternative/

/JAMES RIVER/DR10/ELEVATION-DAMAGE//1986/FLOOD PROOF PLAN B/

The HECDSS enables the pathname to include up to six levels of identifiers (or pathname parts). The SID program uses only the five levels shown between the slash marks.

Different locations and/or assessments of other alternative plans would subsequently have different pathnames. Retrieval of the elevation-damage functions for use by another program (such as HEC-1 or EAD) from the HECDSS would require the use of the same pathnames as that of the events desired. Other data sets stored in HECDSS would require slight variations to the pathname. To the extent possible, interface of the analysis programs with HECDSS (using the pathname concepts) have been made transparent to the user. Prior to the initiation of production executions of the programs, the user must know only the project and the alternative name being investigated. Damage reach names and all other operations are processed internally in the program. The use of HECDSS requires an initial understanding of the procedures and a consensus cataloging of alternative plan names, station names, etc., by the study participants prior to the initiation of production evaluations. While this might seem somewhat burdensome at first, it is a good study management practice for any type of evaluation.

The use of the HECDSS to store SID output for subsequent processing and analysis by other computer programs is specified by the presence of a ZW record. The ZW record must be included to define the pathname label, PROJ (columns 3-16), the alternative to be analyzed, ALT (columns 17-40), and the data year, IYR (columns 45-48). Data variable JDR (DR.1) is automatically processed by the SID program as the damage reach identifier. The user should consequently use damage reach identifiers that are pertinent to the desired analysis.

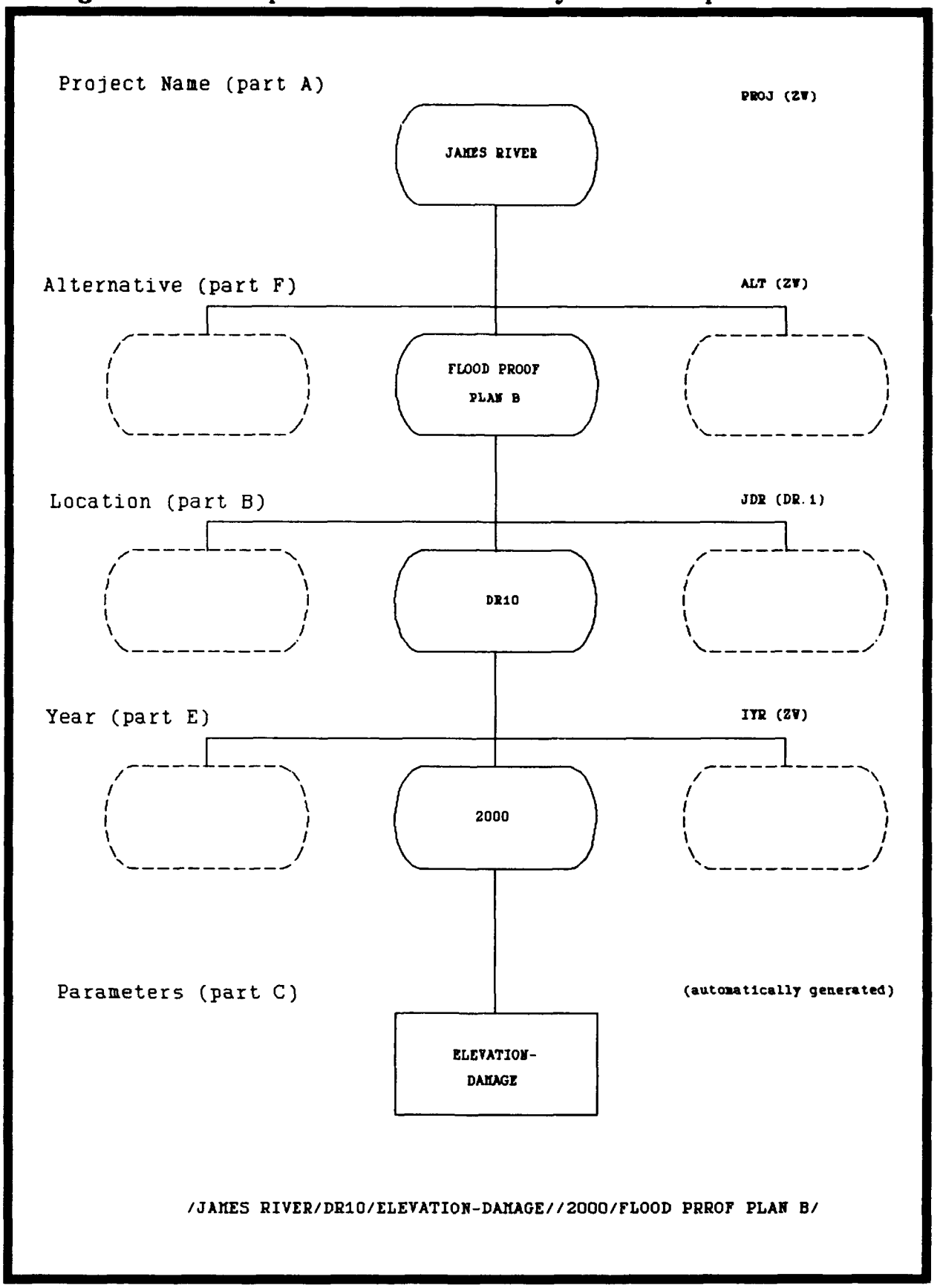
The following paragraphs provide a listing of user considerations pertinent to using the HECDSS.

- The station names, pathname location component, (control points, damage reaches, subbasins, etc.) should be chosen carefully, and if possible, be recognizable locations. The location names used by the programs may be any combination of alphanumeric values except for slashes, which are reserved for HECDSS. The names must be exact for storing and retrieving of the same data set. Leading and trailing blanks are ignored but blanks within the name are considered part of the name.

- A rerun of a program with the exact pathname as a previous execution will eliminate the initial data from any subsequent processing.

Two utility programs, DSSUTL and DSPLAY, are available for editing and displaying DSS data, changing pathnames, purging data sets, and performing numerous other functions on the DSS. See the HEC publication, "HECDSS-User's Guide and Utility Program Manuals," 1983, for further information.

Figure 18: Conceptual Pathname Hierarchy of SID Output to HECDSS



APPENDIX D

Test Problems

Test Problems

Purpose and Overview

The test problems of this Appendix are included to illustrate selected analytical capabilities, input requirements, and output format of the Structure Inventory for Damage Analysis (SID) program. The problems are also intended for use in verification of distributed program code. Five problems are presented in this Appendix; to the extent possible, subsequent problems expand on the previous problem. Selected analytical and display options are illustrated in the examples. The type of analyses and purpose of the problems are summarized below.

Exhibit D-1 This and following problems develop elevation-damage functions by damage category and damage reach. The SID analysis options used in this Exhibit demonstrate the capability of the SID program to perform single event damage analysis, trace designated outputs, and generate summaries of number of structures flooded at various specified levels. The problem is similar to analyses normally performed for "without" condition analyses or for evaluation of damage potential associated with structural alternatives that do not modify the elevation-damage functions.

Exhibit D-2 This Exhibit shows expanded program capabilities over Exhibit D-1 by use of extrapolated sampled data and unique damage categories for content values. The problem is similar to analyses of structural measures or "without" conditions where field inventoried data are not exhaustive of the potential damaged structures.

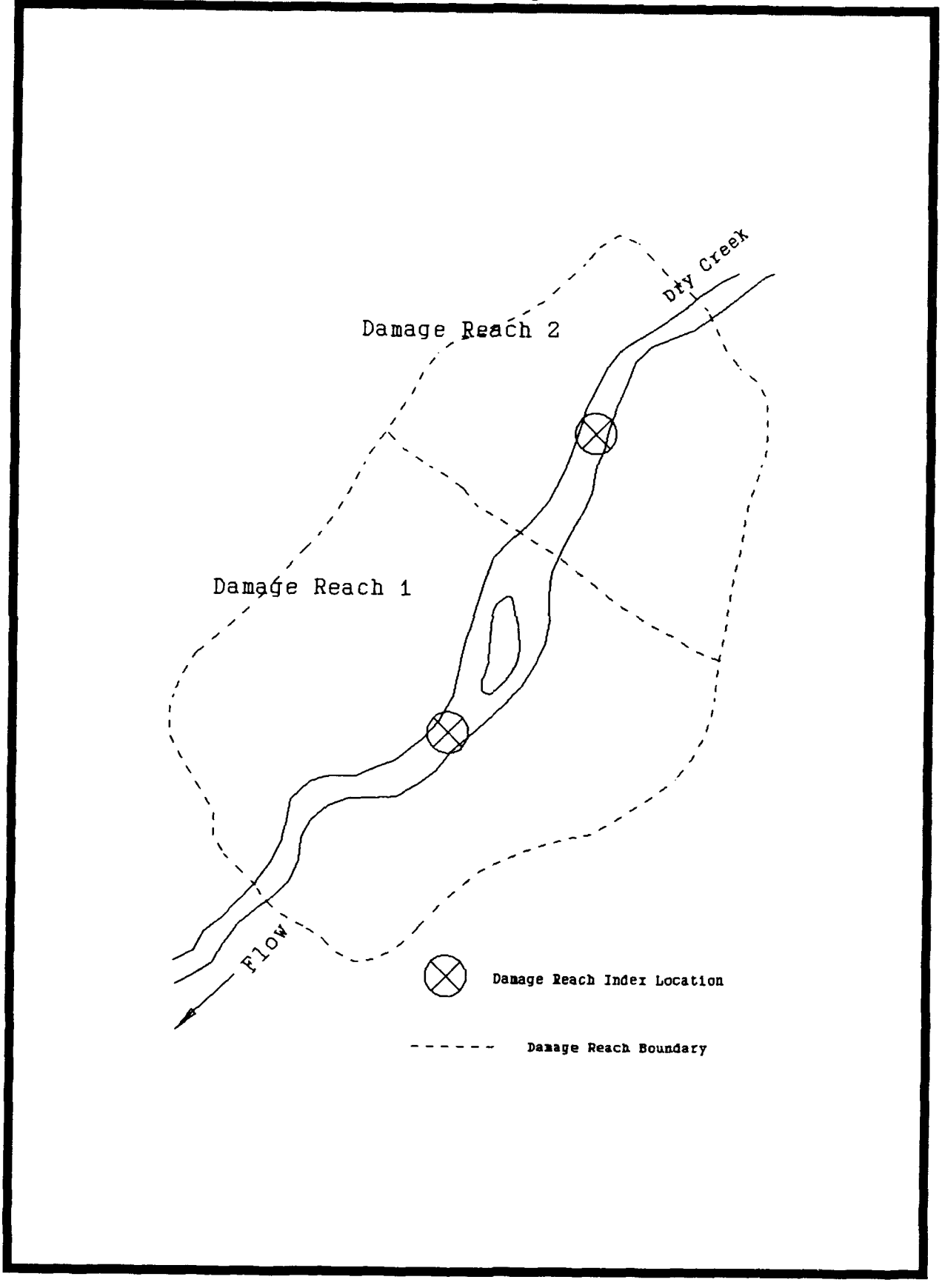
Exhibit D-3 This problem demonstrates SID analysis capabilities for assessing the effects (modified elevation-damage functions) of implementing a nonstructural measure for a specified structure or damage category. The capability and procedures for analyzing and displaying content damage separate from that of structure damage is also shown.

Exhibit D-4 The capability to evaluate the implementation of up to three different nonstructural measures per structure is shown in this problem. For example, permanent raising of a structure along with incremental protection provided by temporary flood proofing actions may be analyzed. Procedures for aggregating damage category and reach data are also shown.

Exhibit D-5 This problem illustrates the automatic linkage of the SID and Expected Annual Damage Computation (EAD) programs via a direct access file, the HEC Data Storage System (DSS). Calculation of expected annual damage and benefits are performed. The problems in Exhibits D-2 and D-3 are used for "without" and "with" conditions, respectively.

Specific problem statements, description of input requirements, and results are provided in Exhibits D-1 through D-5 of this Appendix. The program is designed to efficiently handle from a few up to tens of thousands of structures. However, only a small number of structures are analyzed herein as a demonstration of the capabilities of the program. Subsequent paragraphs provide a general background of the problems described in the Exhibits.

Figure 19: Dry Creek Damage Reach Boundaries



Problem Description

The Corps of Engineers is conducting a planning investigation of the Dry Creek Watershed. (Figure 19) The structures located in damage reaches 1 and 2 have been identified as having potential for implementation of structural and nonstructural flood loss reduction measures. The structures include three mobile homes and two apartment buildings in damage reach 1, and the three residential structures and a commercial building in damage reach 2. Pertinent structure field inventory data have been obtained. The SID program linked via a direct access file (DSS) to the EAD program has been selected to perform the flood damage evaluations.

Damage functions associated with each of the structure categories are shown in TABLES 6 and 7. Elevation-frequency relations for reaches 1 and 2 are depicted TABLE 8. Reference flood elevations at damage index locations one and two equal 494.5 and 503.6, respectively.

Table 6: Stage-Percent Damage Functions

Stage (Feet)	Damage (in percent of structure value) for selected structure types												
	MH1	MH2	HR5	HR6	HR8	HR8	LR1	LR2	LR3	LR4	LR5	LR6	C10
-10									0	0			
-9									4.6	5.7			
-8									11.2	13.6			
-7									16.4	15.7			
-6									21.3	21.3			
-5									28.6	33.3			
-4									33.3	56.9			
-3									42.7	69.7			
-2									54.2	82.5			
-1	0	0							63.9	94.8			
0	8	3	0	0	0	0	0	0	67.9	100.0			0
1	50	30	1	4	4	6	5	6	67.9	100.0			12
2	71	56	8	23	9	11	20	35					27
3	82	72	14	32	16	19	28	45					49
4	87	79	18	38	27	32	33	53					64
5	89	84	22	45	39	47	36	64					77
6	91	87	25	50	51	55	41	73					85
7	91	88	28	53	65	61	43	79					89
8		90	29	55	74	76	46	84			0	0	93
9			30	55	83	87	48	90			2	5	94
10			32	55	91	100					4	12	95
11			36	58	91						7	19	95
12			41	63							9	29	
13			45	65							12	41	
14			48	72							14	58	
15			51	77							17	73	
16			54	82							20	87	
17			57	87							25	89	
18			60	100							32	92	
19			63	100							38	94	
20											43	96	
25											59	96	

Table 7: Stage-Direct Dollar Damage Functions ($1,000)

Stage (feet)	Damage ($1,000) for Functions LR7	LR8
0	0.0	0.0
1	2.5	1.50
2	10.0	8.75
3	14.0	11.25
4	16.5	13.25
5	18.0	16.00
6	20.5	18.25
7	21.5	19.75
8	23.0	21.00
9	24.0	22.50

Table 8: Single Event Elevation-Frequency Data

Return Interval in Years	Elevation (M.S.L.) Damage Reach 1	Damage Reach 2
2	485.3	495.3
5	490.2	498.8
10	492.3	500.6
20	493.5	502.6
50	494.5	503.6
10	495.5	507.7
50	496.3	508.1

EXHIBIT D-1

Development of Elevation-Damage Functions
By Damage Categories and Reaches

Exhibit D-1.

Development of Elevation-Damage Functions by Damage Category and Reach

Problem Purpose

This example represents a basic program execution to develop elevation-damage functions by damage categories and damage reaches for the Dry Creek study area. The example would be analogous to that of base or existing "without" conditions or to that of analysis of structural measures. A trace output, zone summaries, and single event damage values are specified for output. The output for this problem is identical to that defined in the Output Display, Section V of this document. Please review the problem purpose and information provided at the beginning of this Exhibit. Specific analyses are:

- Trace outputs of apartments (damage reach 1) and single family residential structures (damage reach 2);
- Single event computations for 2-, 5-, 10-, 20-, 50-, 100- and 500-year recurrence intervals as shown in Table 8; and
- Flood zone summaries (automatically output with single event analyses)

Description of Input Requirements

The key input data to develop elevation-damage functions and other specified analyses and displays of "without" conditions are defined below: Variable NODF (J2.1) indicates the number of stage-damage functions to be supplied. The TR and TM input records specify desired trace output for structures. The SE and ST records specify single event water surface elevations and corresponding titles. Variable ITYPE (J1.8) specifies the number of single events to be analyzed. The output stage-damage function tables and structure elevation determinations are obtained by specifying IPRNT (J1.5) = 0. Input record listings are specified by IMAGE (J2.6) = 1. Nonstructural evaluations were not performed, therefore, raise-to-target, IPOL (J1.1), flood proofing, IPROF (J1.2), and relocation, IEVAC (J1.3), are each zero. The input listing is provided on the first two output pages in Section V.

Description of Results

A discussion of the output results may be found under Section V, entitled Output Display, of the main text.

The output may be sequentially summarized as showing the input record listing, record images and interpretations, damage functions, damage category and reach information, followed by the structure elevation-damage calculations and damage reach summary tables.

EXHIBIT D-2

Single Event, Damage Category Aggregation, and Sampling Analysis Procedures

Exhibit D-2.
Single Event, Damage Category Aggregation and Sampling Analysis Procedures

Problem Statement

This problem expands on the previous problem D-1 by demonstrating the additional capabilities of the SID program to extrapolate sampled data and to generate categories of content damage values separate from those attributed to structures.

The primary problem objective is to determine flood damage for damage reaches 1 and 2. Sampled data of the reaches were determined to be 10 percent of actual mobile homes, 50 percent of actual apartments, 15 percent of actual single family residential, and 25 percent of commercial structures. The potential damage to the structures contents are grouped into residential (mobile homes, apartments, and residential contents) and commercial (commercial contents) categories separate from those directly associated with the structure categories. Please review the previous problem in Exhibit D-1 and the problem purpose and description at the beginning of Appendix D.

Description of Input Requirements

Variable ISAMP (J1.10) identifies that the data to be analyzed is a sample of the actual population of structures. Data variable ID3 (DR.9) specifies sampling adjustments required by reach and the D3 records specify actual percent sampled values by damage categories.

Content categories are based on specifications of JDCT (DC.2) and aggregation criteria defined on the CC records. Other important input variables are the same as described in Exhibit D-1.

Description of Output

Only selected output pertinent to the desired operations is shown on following pages. The output shown represents that pertinent to the incremental program capabilities demonstrated by this problem. Section V shows additional output that would also be obtained.

Elevation-damage values by damage category and reach are output for both actual and sample-adjusted values. Separate damage categories aggregating all content values into residential content or commercial content categories are shown. These values are subtracted from damage categories of mobile home, residential, apartment and commercial structures.

List of Input Records for This Run

```
T1              TEST 2 - EXISTING CONDITION ANALYSIS
T2               SID - STRUCTURE INVENTORY OF DAMAGE
T3                          MARCH 1989
J1                                                  1              7              1
J2    15       6       2     1.0                   2      18      1
TR     3                                    2
TM    DR1APARTMTS     DR2S.F.RES.
DF    MH1      9
DP    -1.      0.      1.      2.      3.      4.      5.      6.      7.
PC     0.      8.     50.     71.     82.     87.     89.     91.     91.
DF    MH2     10
DP    -1.      0.      1.      2.      3.      4.      5.      6.      7.      8.
PC     0.      3.     30.     56.     72.     79.     84.     87.     88.     90.
DF    HR5     20
DP     0       1       2       3       4       5       6       7       8       9
DP    10      11      12      13      14      15      16      17      18      19
PC     0       1       8      14      18      22      25      28      29      30
PC    32      36      41      45      48      51      54      57      60      63
DF    HR6     20
DP     0       1       2       3       4       5       6       7       8       9
DP    10      11      12      13      14      15      16      17      18      19
PC     0       4      23      32      38      45      50      53      55      55
PC    55      58      63      65      72      77      82      87     100     100
DF    HR7     12
DP     0       1       2       3       4       5       6       7       8       9
DP    10      11
PC     0       4       9      16      27      39      51      65      74      83
PC    91      91
DF    HR8     10
DP     0       1       2       3       4       5       7       9      10      11
PC     0       6      11      19      32      47      61      87     100     100
DF    LR1     10
DP     0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC     0.      5.     20.     28.     33.     36.     41.     43.     46.     48.
DF    LR2     10
DP     0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC     0.      6.     35.     45.     53.     64.     73.     79.     84.     90.
DF    LR3     12
DP   -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP     0.      1.
PC     0.     4.6    11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC   67.9    67.9
DF    LR4     12
DP   -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP     0.      1.
```

```
PC    0.     5.7    13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
PC  100.    100.
DF   LR5      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17.
DP   18.     20.     25.
PC    0.      2.      4.      7.      9.     12.     14.     17.     20.     25.
PC   32.     43.     59.
DF   LR6      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.      17
DP   18.     20.     25.
PC    0.      5.     12.     19.     29.     41.     58.     73.     87.     89.
PC   92.     96.     96.
DF   LR7      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     2.5     10.     14.    16.5    18.0    20.5    21.5    23.     24.
DF   LR8      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     1.5    8.75   11.25   13.25    16.0   18.25   19.75    21.0    22.5
DF   C10      12
DP     0      .5       1       2       3       4       5       6       7       8
DP     9      10
PC     0      12      27      49      64      77      85      89      93      94
PC    95      95
DC      MOBL HOM                MOBILE HOMES
DC      APARTMTS                APARTMENTS
DC      S.F.RES.                SINGLE FAMILY RESIDENCE
DC        RESCON                RESIDENTIAL CONTENTS
DC      COMMERCL                COMMERCIAL
DC        COMCON                COMMERCIAL CONTENTS
CC     3  RESCONMOBL HOMAPARTMTSS.F.RES.
CC     1  COMCONCOMMERCL
DR   DR1   494.5                                485                     1
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
D3   10.     50.
DR   DR2   503.6                                498                     1
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
D3                   15.             25.
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
SL   DR1MOBHOME1                    491.5   491.0
SD   DR1MOBHOME1MOBL HOMMH1  20.MH2   7.        MOBILE HOME
SL   DR1MOBHOME2                    491.3   489.0
SD   DR1MOBHOME2MOBL HOMMH1  15.MH2   5.        MOBILE HOME
SL   DR1MOBHOME3                    493.6   494.1
SD   DR1MOBHOME3MOBL HOMMH1  25.MH2  10.        MOBILE HOME
SL   DR1   APT01                    493.0   494.8           -10.        1
SD   DR1   APT01APARTMTSHR5 780.HR6 281.        13 APARTMENTS            (1SWB)
SO   DR1   APT01HR7 625.HR8 225.
```

```
SL   DR1   APT02                    494.2   493.7
SD   DR1   APT02APARTMTSHR5 880.HR6 325.        22 APARTMENTS        (COMPOSITE)
SL   DR2   RES01                    503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.        SINGLE FAMILY RESIDENCE   (1SNB)
SL   DR2   RES02                    503.5   503.0    -2.0                    1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.         LR5  50.LR6  25.
SL   DR2   RES03                    503.8   504.5                       1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                         LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

J1 0 0 0 0 0 1 0 7 0 1

This job will perform the following

IPOL = 0, No raise-to-target elevation analysis to be considered for this computer run

IPROF = 0, No flood proofing analysis to be considered for this computer run

IEVAC = 0, No structure relocation will be considered for this computer run

IPRNT = 0, Normal Output

ITRACE = 1, Trace output desired

ITYPE = 7, Number of single events for which damage is calculated

IAG = 0, No aggregation of single event damage

ISAMP = 1, Sample by damage reach

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

J2 15 6 2 1.00 0 2 18 1 0

Job Processing Information

NODF = 15 Number of Damage Functions

NODC = 6 Number of Damage Categories

NODR = 2 Number of Damage Reaches

AGG = 1.00, Aggregation interval (in feet)

NFILE = 0, Structure information file

IMAGE = 2, Images of input records will be listed

IELV = 18, The number of elevations to be calculated for the elevation-damage relationships

IMARK = 1, The total (structure+contents+other) value will be used for the structure value flood zone summary

NDFILE = 0, Damage function file

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Categories

Damage Cat.	Damage Category Title	POLMAX	PRFMAX
MOBL HOM	MOBILE HOMES	.00	.00
APARTMTS	APARTMENTS	.00	.00
S.F.RES.	SINGLE FAMILY RESIDENCE	.00	.00
RESCON	RESIDENTIAL CONTENTS	.00	.00
COMMERCL	COMMERCIAL	.00	.00
COMCON	COMMERCIAL CONTENTS	.00	.00
OTHER	OTHER DAMAGE CATEGORIES	.00	.00

Content Category	Contents from structures of the following categories will be used for the content category
RESCON	MOBL HOM APARTMTS S.F.RES.
COMCON	COMMERCL

Damage Reach Index Location Summary

Reach I.D.	Ref Flood Elev	Policy Flood Elev	Flood Proof Elev	Reloc-ation Elev	Start Damage Elev	Damage Elev Incr	Print Option Flag	Sampling Functn Flag
DR1	494.50	.00	.00	.00	485.00	1.00	0	1
DR2	503.60	.00	.00	.00	498.00	1.00	0	1

EXHIBIT D-2

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Single Events for Damage Reaches

Damage Reach	2 YEAR EVENT	5 YEAR EVENT	10 YEAR EVENT	20 YEAR EVENT	50 YEAR EVENT	100 YEAR EVENT	500 YEAR EVENT
DR1	485.30	490.20	492.30	493.50	494.50	495.50	496.30
DR2	495.30	498.80	500.60	502.60	503.60	507.70	508.10

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Structure I.D.= APT01 Ref. flood elev.= 493.00
13 APARTMENTS (1SWB) Structure reference elevation = 494.80
Damage reach DR1 Reference elev. at index = 496.30
Damage category APARTMTS

		First Floor			Basement			
		Structure	Content	Other	Structure	Content	Other	Total
Total Value		780000.	281000.	0.	625000.	225000.	0.	1911000.
Damage function		HR5	HR6		HR7	HR8		

Stage	Index Elev	First Floor Structure	First Floor Content	First Floor Other	Basement Structure	Basement Content	Basement Other	Total Total
-10.00	486.30	0.	0.	0.	0.	0.	0.	0.
-9.50	486.80	0.	0.	0.	12500.	6750.	0.	19250.
-9.00	487.30	0.	0.	0.	25000.	13500.	0.	38500.
-8.50	487.80	0.	0.	0.	40625.	19125.	0.	59750.
-8.00	488.30	0.	0.	0.	56250.	24750.	0.	81000.
-7.50	488.80	0.	0.	0.	78125.	33750.	0.	111875.
-7.00	489.30	0.	0.	0.	100000.	42750.	0.	142750.
-6.50	489.80	0.	0.	0.	134375.	57375.	0.	191750.
-6.00	490.30	0.	0.	0.	168750.	72000.	0.	240750.
-5.50	490.80	0.	0.	0.	206250.	88875.	0.	295125.
-5.00	491.30	0.	0.	0.	243750.	105750.	0.	349500.
-4.50	491.80	0.	0.	0.	281250.	113625.	0.	394875.
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.
-3.50	492.80	0.	0.	0.	362500.	129375.	0.	491875.
-3.00	493.30	0.	0.	0.	406250.	137250.	0.	543500.
-2.50	493.80	0.	0.	0.	434375.	151875.	0.	586250.
-2.00	494.30	0.	0.	0.	462500.	166500.	0.	629000.
-1.50	494.80	0.	0.	0.	490625.	181125.	0.	671750.
-1.00	495.30	0.	0.	0.	518750.	195750.	0.	714500.
-.50	495.80	0.	0.	0.	543750.	210375.	0.	754125.
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.
.50	496.80	3900.	5620.	0.	568750.	225000.	0.	803270.
1.00	497.30	7800.	11240.	0.	568750.	225000.	0.	812790.
1.50	497.80	35100.	37935.	0.	568750.	225000.	0.	866785.
2.00	498.30	62400.	64630.	0.	568750.	225000.	0.	920780.
2.50	498.80	85800.	77275.	0.	568750.	225000.	0.	956825.
3.00	499.30	109200.	89920.	0.	568750.	225000.	0.	992870.
3.50	499.80	124800.	98350.	0.	568750.	225000.	0.	1016900.
4.00	500.30	140400.	106780.	0.	568750.	225000.	0.	1040930.
4.50	500.80	156000.	116615.	0.	568750.	225000.	0.	1066365.

5.00	501.30	171600.	126450.	0.	568750.	225000.	0.	1091800.
5.50	501.80	183300.	133475.	0.	568750.	225000.	0.	1110525.
6.00	502.30	195000.	140500.	0.	568750.	225000.	0.	1129250.
6.50	502.80	206700.	144715.	0.	568750.	225000.	0.	1145165.
2 YEAR								
-11.00	485.30	0.	0.	0.	0.	0.	0.	0.
5 YEAR								
-6.10	490.20	0.	0.	0.	161877.	69076.	0.	230952.
10 YEAR								
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.
20 YEAR								
-2.80	493.50	0.	0.	0.	417501.	143100.	0.	560601.
50 YEAR								
-1.80	494.50	0.	0.	0.	473751.	172350.	0.	646101.
100 YEAR								
-.80	495.50	0.	0.	0.	528751.	201600.	0.	730351.
500 YEAR								
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.

Damage was not calculated for entire stage damage function for Structure.
Damage was not calculated above maximum elevation for damage reach.

Basement damage functions were adjusted -10.0 feet to reflect the
difference between the first floor and basement elevations (DELTB).

Contents damage for this structure was placed in content category RESCON.

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1

Number of Structures in Flood Zones
(Based on First Floor Elevations)

Dmg Cat	Zero TO *2 YEAR	*2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO *100 YEAR	*100 YEAR TO *500 YEAR	*ABOVEMAX					Total
	Flood Zone												
MOBL HOM	0	0	1	0	1	1	0	0	0	0	0	0	3
APARTMTS	0	0	0	0	1	0	1	0	0	0	0	0	2
* RESCON*	0	0	1	0	2	1	1	0	0	0	0	0	5
* Total *	0	0	2	0	4	2	2	0	0	0	0	0	10

Number of Structures in Flood Zones
(Based on Zero Damage Elevations)

Dmg Cat	Zero TO *2 YEAR	*2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO *100 YEAR	*100 YEAR TO *500 YEAR	*ABOVEMAX					Total
	Flood Zone												
MOBL HOM	0	0	1	1	1	0	0	0	0	0	0	0	3
APARTMTS	0	1	0	0	1	0	0	0	0	0	0	0	2
* RESCON*	0	1	1	1	2	0	0	0	0	0	0	0	5
* Total *	0	2	2	2	4	0	0	0	0	0	0	0	10

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
Structural Value Flood Zone Summary
(at first floor elevation)
value is in $1,000

	Flood Zone										
Dmg Cat	Zero TO 2 YEAR	2 YEAR TO 5 YEAR	5 YEAR TO 10 YEAR	10 YEAR TO 20 YEAR	20 YEAR TO 50 YEAR	50 YEAR TO 100 YEAR	100 YEAR TO 500 YEAR	ABOVEMAX				Total
MOBL HOM	.0	.0	15.0	.0	20.0	25.0	.0	.0	.0	.0	.0	60.0
APARTMTS	.0	.0	.0	.0	880.0	.0	1405.0	.0	.0	.0	.0	2285.0
RESCON	.0	.0	5.0	.0	332.0	10.0	506.0	.0	.0	.0	.0	853.0
Total	.0	.0	20.0	.0	1232.0	35.0	1911.0	.0	.0	.0	.0	3198.0

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
DRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
(Damages are in $1,000)

Damage Categories
(percent sampled)

Water Surface Elevation	MOBL HOM (10.0)	APARTMTS (50.0)	S.F.RES. (100.0)	RESCON (100.0)	COMMERCL (100.0)	COMCON (100.0)	OTHER (100.0)	(.0)	(.0)	(.0)	Total
485.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
486.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
487.00	.0	17.5	.0	18.9	.0	.0	.0	.0	.0	.0	36.4
488.00	.0	46.9	.0	42.8	.0	.0	.0	.0	.0	.0	89.6
489.00	.0	86.9	.0	74.7	.0	.0	.0	.0	.0	.0	161.6
490.00	.0	148.1	.0	126.5	.0	.0	.0	.0	.0	.0	274.6
491.00	.0	221.3	.0	191.3	.0	.0	.0	.0	.0	.0	412.5
492.00	1.0	296.3	.0	234.8	.0	.0	.0	.0	.0	.0	532.0
493.00	6.2	380.0	.0	277.4	.0	.0	.0	.0	.0	.0	663.6
494.00	11.6	445.6	.0	343.0	.0	.0	.0	.0	.0	.0	800.2
495.00	24.0	510.7	.0	458.4	.0	.0	.0	.0	.0	.0	993.0
496.00	39.6	624.2	.0	690.0	.0	.0	.0	.0	.0	.0	1353.7
497.00	47.4	697.4	.0	821.6	.0	.0	.0	.0	.0	.0	1566.5
498.00	51.5	773.2	.0	964.7	.0	.0	.0	.0	.0	.0	1789.4
499.00	53.2	857.5	.0	1088.9	.0	.0	.0	.0	.0	.0	1999.6
500.00	54.1	919.8	.0	1168.1	.0	.0	.0	.0	.0	.0	2142.0
501.00	54.6	977.4	.0	1229.2	.0	.0	.0	.0	.0	.0	2261.2
502.00	54.6	1011.9	.0	1276.1	.0	.0	.0	.0	.0	.0	2342.6

(2 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 485.30 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(5 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 490.20 *	.0 *	161.9 *	.0 *	138.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	300.0 *
(10 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 492.30 *	1.8 *	318.8 *	.0 *	245.8 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	566.4 *
(20 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 493.50 *	9.2 *	417.5 *	.0 *	306.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	732.9 *
(50 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 494.50 *	17.9 *	478.2 *	.0 *	401.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	897.2 *
(100 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 495.50 *	31.9 *	568.4 *	.0 *	574.6 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1174.8 *
(500 YEAR)	*	*	*	*	*	*	*	*	*	*	*
* 496.30 *	42.0 *	655.0 *	.0 *	737.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1434.2 *

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category RESCON identified as RESIDENTIAL CONTENTS
Damage category COMMERCL identified as COMMERCIAL
Damage category COMCON identified as COMMERCIAL CONTENTS
Damage category OTHER identified as OTHER DAMAGE CATEGORIES

TEST 2 - EXISTING CONDITION ANALYSIS
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
DRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
(Damages are in $1,000)

Damage Categories

Elevation	MOBL HOM	APARTMTS	S.F.RES.	RESCON	COMMERCL	COMCON	OTHER				Total
485.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
486.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
487.00	.0	35.0	.0	18.9	.0	.0	.0	.0	.0	.0	53.9
488.00	.0	93.8	.0	42.8	.0	.0	.0	.0	.0	.0	136.5
489.00	.0	173.8	.0	74.7	.0	.0	.0	.0	.0	.0	248.5
490.00	.0	296.3	.0	126.5	.0	.0	.0	.0	.0	.0	422.7
491.00	.0	442.5	.0	191.3	.0	.0	.0	.0	.0	.0	633.8
492.00	9.6	592.5	.0	234.8	.0	.0	.0	.0	.0	.0	836.9
493.00	62.4	760.0	.0	277.4	.0	.0	.0	.0	.0	.0	1099.8
494.00	116.2	891.3	.0	343.0	.0	.0	.0	.0	.0	.0	1350.4
495.00	239.7	1021.4	.0	458.4	.0	.0	.0	.0	.0	.0	1719.4
496.00	396.0	1248.3	.0	690.0	.0	.0	.0	.0	.0	.0	2334.3
497.00	474.4	1394.8	.0	821.6	.0	.0	.0	.0	.0	.0	2690.9
498.00	514.9	1546.3	.0	964.7	.0	.0	.0	.0	.0	.0	3026.0
499.00	532.0	1715.0	.0	1088.9	.0	.0	.0	.0	.0	.0	3335.9
500.00	541.0	1839.6	.0	1168.1	.0	.0	.0	.0	.0	.0	3548.7
501.00	546.0	1954.8	.0	1229.2	.0	.0	.0	.0	.0	.0	3730.0
502.00	546.0	2023.9	.0	1276.1	.0	.0	.0	.0	.0	.0	3845.9

(2 YEAR)											
485.30	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
(5 YEAR)											
490.20	.0	323.8	.0	138.2	.0	.0	.0	.0	.0	.0	461.9
(10 YEAR)											
492.30	18.3	637.5	.0	245.8	.0	.0	.0	.0	.0	.0	901.6
(20 YEAR)											
493.50	92.4	835.0	.0	306.2	.0	.0	.0	.0	.0	.0	1233.6
(50 YEAR)											
494.50	179.4	956.3	.0	401.2	.0	.0	.0	.0	.0	.0	1536.9
(100 YEAR)											
495.50	318.7	1136.7	.0	574.6	.0	.0	.0	.0	.0	.0	2030.1
(500 YEAR)											
496.30	420.1	1310.0	.0	737.2	.0	.0	.0	.0	.0	.0	2467.3

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category RESCON identified as RESIDENTIAL CONTENTS
Damage category COMMERCL identified as COMMERCIAL
Damage category COMCON identified as COMMERCIAL CONTENTS
Damage category OTHER identified as OTHER DAMAGE CATEGORIES
** Note ** *damage category OTHER is not changed by sampling*

EXHIBIT D-3

Nonstructural Analysis
Single Measure per Structure

Exhibit D-3.
Nonstructural Analysis, Single Measure Per Structure

Problem Statement

This sample problem is intended to show the capabilities of modifying elevation-damage relationships by evaluating nonstructural flood mitigation measures. A single measure per structure is analyzed.

Actions to be evaluated include measures designed to raise single family residential structures to the 20-year recurrence interval, flood proof apartments and commercial structures to the 50-year level, and relocate mobile homes with first floor elevations below the 20-year recurrence interval. Damage values associated with single event occurrences of 2-, 5-, 10-, 20-, 50-, 100- and 500-year events are to be determined. Please review problem purpose and description in the beginning of this appendix.

Description of Input Requirements

Key input data variables for specifying raise-to-target, flood proofing, and relocating analyses are IPOL (J1.1), IPROF (J1.2) and IEVAC (J1.3), respectively. The J3, J5, and J8 records are used to specify the damage categories to be raised, flood proofed, and relocated, respectively. Target elevations are specified on the DR record (DR.3, DR.4, and DR.5, respectively).

Description of Results

The output results provide information for the amount of raising, flood proofing, or relocation. The physical feasibility, social, and other issues of implementing such actions must subsequently be assessed by the user.

Damage reach 1 analysis indicates that mobile home structures MOBHOME1 and MOBHOME3 are located above the 20-year flood recurrence interval and were not relocated. MOBHOME2 was relocated since the first floor elevation adjusted to the index location, 492.2 m.s.l., is less than the 20-year target elevation of 493.5 m.s.l. The apartment structure APT01 was flood proofed 8.20 feet to provide protection to the target level. However, this height of flood proofing is obviously physically not feasible as indicated by the user specified feasible limit flag of 3.0 feet. The basement function was adjusted a -10.0 feet to reflect the difference between the first floor and basement floor elevations (DELTB). Structure APT02 was flood proofed 0.50 feet to meet the 20-year protection target level.

The results for damage reach 2 show that the damage function of residential structure RES02 was truncated at -2.0 feet, the difference in stage between the first floor and lowest opening (DELTZ). Damage does not occur in the basement until water reaches the basement window. Determination of the first floor elevation of structure RES03 was performed by adding the difference between the first floor elevation and ground elevation (DELTG) to the structure reference elevation (STOPO).

List of Input Records for This Run

```
T1 TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
T2              SID - STRUCTURE INVENTORY OF DAMAGE
T3                          MARCH 1989
J1    1       1       1                 2                       7               1
J2   15       6       2      1.0                2                1
J3     1S.F.RES.
J5     2APARTMTSCOMMERCL
J8     1MOBL HOM
DF   MH1      9
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.
PC    0.      8.     50.     71.     82.     87.     89.     91.     91.
DF   MH2     10
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.      8.
PC    0.      3.     30.     56.     72.     79.     84.     87.     88.     90.
DF   HR5     20
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       1       8      14      18      22      25      28      29      30
PC   32      36      41      45      48      51      54      57      60      63
DF   HR6     20
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       4      23      32      38      45      50      53      55      55
PC   55      58      63      65      72      77      82      87     100     100
DF   HR7     12
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11
PC    0       4       9      16      27      39      51      65      74      83
PC   91      91
DF   HR8     10
DP    0       1       2       3       4       5       7       9      10      11
PC    0       6      11      19      32      47      61      87     100     100
DF   LR1     10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      5.     20.     28.     33.     36.     41.     43.     46.     48.
DF   LR2     10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      6.     35.     45.     53.     64.     73.     79.     84.     90.
DF   LR3     12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.     4.6     11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC  67.9    67.9
DF   LR4     12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.     5.7     13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
```

```
PC  100.    100.
DF   LR5     13
DP    8.     9.    10.    11.    12.    13.    14.    15.    16.    17.
DP   18.    20.    25.
PC    0.     2.     4.     7.     9.    12.    14.    17.    20.    25.
PC   32.    43.    59.
DF   LR6     13
DP    8.     9.    10.    11.    12.    13.    14.    15.    16.    17
DP   18.    20.    25.
PC    0.     5.    12.    19.    29.    41.    58.    73.    87.    89.
PC   92.    96.    96.
DF   LR7     10      1
DP    0.     1.     2.     3.     4.     5.     6.     7.     8.     9.
DD    0.    2.5    10.    14.   16.5   18.0   20.5   21.5   23.    24.
DF   LR8     10      1
DP    0.     1.     2.     3.     4.     5.     6.     7.     8.     9.
DD    0.    1.5   8.75  11.25  13.25   16.0  18.25  19.75   21.0   22.5
DF   C10     12
DP     0     .5      1      2      3      4      5      6      7      8
DP     9     10
PC     0     12     27     49     64     77     85     89     93     94
PC    95     95
DC     MOBL HOM              MOBILE HOMES
DC     APARTMTS            3.0APARTMENTS
DC     S.F.RES.    5.0       SINGLE FAMILY RESIDENCE
DC       RESCON              RESIDENTIAL CONTENTS
DC     COMMERCL              COMMERCIAL
DC       COMCON              COMMERCIAL CONTENTS
CC     3 RESCONMOBL HOMAPARTMTSS.F.RES.
CC     1 COMCONCOMMERCL
DR  DR1   494.5   493.5   494.5   492.3     485                    1
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3  490.2   492.3   493.5   494.5   495.5   496.3
D3  10.     50.
DR  DR2   503.6   502.6   503.6   500.6     498     1.0            1
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3  498.8   500.6   502.6   503.6   507.7   508.1
D3                 15.             25.
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
SL  DR1MOBHOME1                   491.5   491.0
SD  DR1MOBHOME1MOBL HOMMH1  20.MH2   7.       MOBILE HOME
SL  DR1MOBHOME2                   491.3   489.0
SD  DR1MOBHOME2MOBL HOMMH1  15.MH2   5.       MOBILE HOME
SL  DR1MOBHOME3                   493.6   494.1
SD  DR1MOBHOME3MOBL HOMMH1  25.MH2  10.       MOBILE HOME
SL  DR1   APT01                   493.0   494.8          -10.      1
SD  DR1   APT01APARTMTSHR5 780.HR6 281.       13 APARTMENTS          (1SWB)
SO  DR1   APT01HR7 625.HR8 225.
SL  DR1   APT02                   494.2   493.7
```

```
SD   DR1   APT02APARTMTSHR5 880.HR6 325.        22 APARTMENTS        (COMPOSITE)
SL   DR2   RES01                    503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.        SINGLE FAMILY RESIDENCE   (1SNB)
SL   DR2   RES02                    503.5   503.0    -2.0                1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.        LR5  50.LR6  25.
SL   DR2   RES03                    503.8   504.5                    1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                       LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

J1 1 1 1 0 2 0 0 7 0 1

This job will perform the following

IPOL = 1, All structures within specified damage categories to be raised above target flood elevation

IPROF = 1, All structures within specified damage categories are flood proofed to target flood elevation

IEVAC = 1, All structures within specified damage categories will be relocated which have a reference elevation below the target flood elevation

IPRNT = 2, Suppress damage function printout

ITRACE = 0, No trace output

ITYPE = 7, Number of single events for which damage is calculated

IAG = 0, No aggregation of single event damage

ISAMP = 1, Sample by damage reach

EXHIBIT D-3

The following damage categories are subject to raising

S.F.RES.

The following damage categories are subject to flood proofing

APARTMTS COMMERCL

The following damage categories will be relocated
according to the relocation policy

MOBL HOM

Order of action

IOA(1) = 1, run RAISING STRUCTURES first
IOA(2) = 2, run FLOODPROOFING second
IOA(3) = 3, run RELOCATION last

Damage Reach Index Location Summary

Reach I.D.	Ref Flood Elev	Policy Flood Elev	Flood Proof Elev	Reloc- ation Elev	Start Damage Elev	Damage Elev Incr	Print Option Flag	Sampling Functn Flag
DR1	494.50	493.50	494.50	492.30	485.00	1.00	0	1
DR2	503.60	502.60	503.60	500.60	498.00	1.00	0	1

Single Events for Damage Reaches

Damage Reach	2 YEAR EVENT	5 YEAR EVENT	10 YEAR EVENT	20 YEAR EVENT	50 YEAR EVENT	100 YEAR EVENT	500 YEAR EVENT
DR1	485.30	490.20	492.30	493.50	494.50	495.50	496.30
DR2	495.30	498.80	500.60	502.60	503.60	507.70	508.10

TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Structure I.D.= APT01 Ref. flood elev.= 493.00
13 APARTMENTS (1SWB) Structure reference elevation = 494.80
Damage reach DR1 Reference elev. at index = 496.30
Damage category APARTMTS

		First Floor			Basement			
		Structure	Content	Other	Structure	Content	Other	Total
Total Value		780000.	281000.	0.	625000.	225000.	0.	1911000.
Damage function		HR5	HR6		HR7	HR8		

Stage	Index Elev	First Floor Structure	First Floor Content	First Floor Other	Basement Structure	Basement Content	Basement Other	Total Total
-10.00	486.30	0.	0.	0.	0.	0.	0.	0.
-9.50	486.80	0.	0.	0.	0.	0.	0.	0.
-9.00	487.30	0.	0.	0.	0.	0.	0.	0.
-8.50	487.80	0.	0.	0.	0.	0.	0.	0.
-8.00	488.30	0.	0.	0.	0.	0.	0.	0.
-7.50	488.80	0.	0.	0.	0.	0.	0.	0.
-7.00	489.30	0.	0.	0.	0.	0.	0.	0.
-6.50	489.80	0.	0.	0.	134375.	57375.	0.	191750.
-6.00	490.30	0.	0.	0.	168750.	72000.	0.	240750.
-5.50	490.80	0.	0.	0.	206250.	88875.	0.	295125.
-5.00	491.30	0.	0.	0.	243750.	105750.	0.	349500.
-4.50	491.80	0.	0.	0.	281250.	113625.	0.	394875.
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.
-3.50	492.80	0.	0.	0.	362500.	129375.	0.	491875.
-3.00	493.30	0.	0.	0.	406250.	137250.	0.	543500.
-2.50	493.80	0.	0.	0.	434375.	151875.	0.	586250.
-2.00	494.30	0.	0.	0.	462500.	166500.	0.	629000.
-1.50	494.80	0.	0.	0.	490625.	181125.	0.	671750.
-1.00	495.30	0.	0.	0.	518750.	195750.	0.	714500.
-.50	495.80	0.	0.	0.	543750.	210375.	0.	754125.
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.
.50	496.80	3900.	5620.	0.	568750.	225000.	0.	803270.
1.00	497.30	7800.	11240.	0.	568750.	225000.	0.	812790.
1.50	497.80	35100.	37935.	0.	568750.	225000.	0.	866785.
2.00	498.30	62400.	64630.	0.	568750.	225000.	0.	920780.
2.50	498.80	85800.	77275.	0.	568750.	225000.	0.	956825.
3.00	499.30	109200.	89920.	0.	568750.	225000.	0.	992870.
3.50	499.80	124800.	98350.	0.	568750.	225000.	0.	1016900.
4.00	500.30	140400.	106780.	0.	568750.	225000.	0.	1040930.
4.50	500.80	156000.	116615.	0.	568750.	225000.	0.	1066365.

5.00	501.30	171600.	126450.	0.	568750.	225000.	0.	1091800.	
5.50	501.80	183300.	133475.	0.	568750.	225000.	0.	1110525.	
6.00	502.30	195000.	140500.	0.	568750.	225000.	0.	1129250.	
6.50	502.80	206700.	144715.	0.	568750.	225000.	0.	1145165.	
2 YEAR									
-11.00	485.30	0.	0.	0.	0.	0.	0.	0.	
5 YEAR									
-6.10	490.20	0.	0.	0.	161877.	69076.	0.	230952.	
10 YEAR									
-4.00	492.30	0.	0.	0.	318750.	121500.	0.	440250.	
20 YEAR									
-2.80	493.50	0.	0.	0.	417501.	143100.	0.	560601.	
50 YEAR									
-1.80	494.50	0.	0.	0.	473751.	172350.	0.	646101.	
100 YEAR									
-.80	495.50	0.	0.	0.	528751.	201600.	0.	730351.	
500 YEAR									
.00	496.30	0.	0.	0.	568750.	225000.	0.	793750.	

Damage was not calculated for entire stage damage function for Structure.
Damage was not calculated above maximum elevation for damage reach.

Basement damage functions were adjusted -10.0 feet to reflect the
difference between the first floor and basement elevations (DELTB).

Contents damage for this structure was placed in content category RESCON.

This structure was flood proofed to 489.30 feet (total of 3.00 feet
with respect to zero damage point) which is less than the requested depth of
8.20 feet which exceeded the feasible limit (PRFMAX(DC)) of 3.00 feet.

The contents for this structure were flood proofed to 489.30 feet (total of 3.00
feet with respect to zero damage point) to comply with flood proofing requirements.

TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Structure I.D.= RES01 Ref. flood elev.= 503.40
SINGLE FAMILY RESIDENCE (1SNB) Structure reference elevation = 502.00
Damage reach DR2 Reference elev. at index = 502.60
Damage category S.F.RES.

	Structure	Contents	Other	Total
Total Value	50000.	25000.	0.	75000.
Damage Function	LR7	LR8		

Stage	Index Elev	Structure	Contents	Other	Total
.00	502.60	0.	0.	0.	0.
.50	503.10	1250.	750.	0.	2000.
1.00	503.60	2500.	1500.	0.	4000.
1.50	504.10	6250.	5125.	0.	11375.
2.00	504.60	10000.	8750.	0.	18750.
2.50	505.10	12000.	10000.	0.	22000.
3.00	505.60	14000.	11250.	0.	25250.
3.50	506.10	15250.	12250.	0.	27500.
4.00	506.60	16500.	13250.	0.	29750.
4.50	507.10	17250.	14625.	0.	31875.
5.00	507.60	18000.	16000.	0.	34000.
5.50	508.10	19250.	17125.	0.	36375.
6.00	508.60	20500.	18250.	0.	38750.
6.50	509.10	21000.	19000.	0.	40000.
7.00	509.60	21500.	19750.	0.	41250.
7.50	510.10	22250.	20375.	0.	42625.
8.00	510.60	23000.	21000.	0.	44000.
8.50	511.10	23500.	21750.	0.	45250.
9.00	511.60	24000.	22500.	0.	46500.

2 YEAR						
-7.30	495.30	0.	0.	0.	0.	
5 YEAR						
-3.80	498.80	0.	0.	0.	0.	
10 YEAR						
-2.00	500.60	0.	0.	0.	0.	
20 YEAR						
.00	502.60	0.	0.	0.	0.	
50 YEAR						
1.00	503.60	2500.	1500.	0.	4000.	
100 YEAR						
5.10	507.70	18250.	16225.	0.	34475.	
500 YEAR						
5.50	508.10	19250.	17125.	0.	36375.	

Contents damage for this structure was placed in content category RESCON.

This structure was raised .40 feet.

The contents for this structure were raised .40 feet.

TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1

Flood Proofing Summary

The following buildings were flood proofed

Building	Amount of flood proofing
APT01	3.00 (Feasible limit)
APT02	.50
2 Buildings were floodproofed a total of	3.50 feet

Relocation Summary

The following buildings were permanently relocated

Building
MOBHOME2

1 Buildings were permanently relocated

TEST 3 - RAISING , FLOOD PROOFING , OR RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
DRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
(Damages are in $1,000)

Water Surface Elevation	MOBL HOM (10.0)	APARTMTS (50.0)	S.F.RES. (100.0)	RESCON (100.0)	COMMERCL (100.0)	COMCON (100.0)	OTHER (100.0)	(.0)	(.0)	(.0)	Total	
	Damage Categories (percent sampled)											
485.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
486.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
487.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
488.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
489.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
490.00	.0	148.1	.0	126.5	.0	.0	.0	.0	.0	.0	274.6	
491.00	.0	221.3	.0	191.3	.0	.0	.0	.0	.0	.0	412.5	
492.00	.0	296.3	.0	233.6	.0	.0	.0	.0	.0	.0	529.8	
492.30	.0	318.8	.0	243.0	.0	.0	.0	.0	.0	.0	561.8	EVCELV
493.00	.0	380.0	.0	265.1	.0	.0	.0	.0	.0	.0	645.1	
493.50	.8	417.5	.0	287.3	.0	.0	.0	.0	.0	.0	705.6	POLELV
494.00	1.6	445.6	.0	317.6	.0	.0	.0	.0	.0	.0	764.8	
494.50	6.8	473.8	.0	357.8	.0	.0	.0	.0	.0	.0	838.3	PROELV
495.00	12.0	510.7	.0	424.0	.0	.0	.0	.0	.0	.0	946.6	
496.00	26.7	624.2	.0	651.2	.0	.0	.0	.0	.0	.0	1302.0	
497.00	34.2	697.4	.0	780.1	.0	.0	.0	.0	.0	.0	1511.7	
498.00	37.9	773.2	.0	921.5	.0	.0	.0	.0	.0	.0	1732.6	
499.00	39.5	857.5	.0	1045.0	.0	.0	.0	.0	.0	.0	1942.0	
500.00	40.5	919.8	.0	1123.3	.0	.0	.0	.0	.0	.0	2083.6	
501.00	41.0	977.4	.0	1184.2	.0	.0	.0	.0	.0	.0	2202.5	
502.00	41.0	1011.9	.0	1231.1	.0	.0	.0	.0	.0	.0	2284.0	

(2 YEAR)											
* 485.30 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(5 YEAR)											
* 490.20 *	.0 *	161.9 *	.0 *	138.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	300.0 *
(10 YEAR)											
* 492.30 *	.0 *	318.8 *	.0 *	243.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	561.8 *
(20 YEAR)											
* 493.50 *	.8 *	417.5 *	.0 *	287.3 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	705.6 *
(50 YEAR)											
* 494.50 *	6.8 *	473.8 *	.0 *	357.8 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	838.3 *
(100 YEAR)											
* 495.50 *	19.4 *	568.4 *	.0 *	537.6 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1125.3 *
(500 YEAR)											
* 496.30 *	28.9 *	655.0 *	.0 *	697.4 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1381.3 *

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category RESCON identified as RESIDENTIAL CONTENTS
Damage category COMMERCL identified as COMMERCIAL
Damage category COMCON identified as COMMERCIAL CONTENTS
Damage category OTHER identified as OTHER DAMAGE CATEGORIES

EXHIBIT D-4

Multiple Measure Nonstructural Actions per Structure

Exhibit D-4.
Multiple Measure Nonstructural Actions Per Structure

Problem Description

The purpose of this sample problem is to illustrate the capability of evaluating the implementation of multiple actions to individual structures. For example, a future structure may be raised (constructed on fill, etc.) to meet a regulatory policy elevation and flood proofed to provide an additional increment of protection. The user may specify the order of implementation on the OA record. The default order is raise-to-target elevation, flood proof and relocation. Please review problem purpose and description in the beginning of this appendix.

Mobile homes with first floor elevations below the 10-year recurrence interval are to be relocated. Single family structures between the 10- and 20-year recurrence intervals are to be raised to meet regulatory policy criteria. In addition, analyses of flood proofing single family residential apartments and commercial structures to the 50-year protection level is desired. Determine associated damage values for single events 2-, 5-, 10-, 20-, 50-, 100-, and 500-year flood. Aggregate single event damage values for structure damage associated with mobile homes, apartments, and single family residential into one category called residential. Finally, aggregate damage values for damage reaches 1 and 2 into one damage reach, titled damage reach 1.

Description of Input Requirements

Key input variables IPOL (J1.1), IPROF (J1.2), and IEVAC (J1.3) specifying raise-to-target, flood proofing and relocation specifications, respectively. Variable IAG (J1.9) was set equal to 3 for aggregation of single event damage values. Designated damage categories for these actions were specified on the J3, J5 and J8 records, respectively. The associated target elevations were specified on the DR record.

Description of Results

Mobile home MOBHOME2 was relocated, while structures MOBHOME1 and MOBHOME3 were not affected since they were above target elevations. Structure APT01 was assumed flood proofed 8.20 feet (probably not physically feasible), and APT02, .50 feet. Residential structure RES01 in damage reach 2 was elevated .40 feet and flood proofed 1.00 feet.

List of Input Records for This Run

```
T1 TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
T2              SID - STRUCTURE INVENTORY OF DAMAGE
T3                          MARCH 1989
J1    1       1       1               2                       7       3       1
J2   15       6       2     1.0               2               1
J3     1S.F.RES.
J5     3APARTMTSCOMMERCLS.F.RES.
J8     2MOBL HOMS.F.RES.
DF   MH1       9
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.
PC    0.      8.     50.     71.     82.     87.     89.     91.     91.
DF   MH2      10
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.      8.
PC    0.      3.     30.     56.     72.     79.     84.     87.     88.     90.
DF   HR5      20
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       1       8      14      18      22      25      28      29      30
PC   32      36      41      45      48      51      54      57      60      63
DF   HR6      20
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       4      23      32      38      45      50      53      55      55
PC   55      58      63      65      72      77      82      87     100     100
DF   HR7      12
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11
PC    0       4       9      16      27      39      51      65      74      83
PC   91      91
DF   HR8      10
DP    0       1       2       3       4       5       7       9      10      11
PC    0       6      11      19      32      47      61      87     100     100
DF   LR1      10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      5.     20.     28.     33.     36.     41.     43.     46.     48.
DF   LR2      10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      6.     35.     45.     53.     64.     73.     79.     84.     90.
DF   LR3      12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.     4.6    11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC  67.9    67.9
DF   LR4      12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
```

```
DP    0.      1.
PC    0.     5.7    13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
PC  100.    100.
DF   LR5      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17.
DP   18.     20.     25.
PC    0.      2.      4.      7.      9.     12.     14.     17.     20.     25.
PC   32.     43.     59.
DF   LR6      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.      17
DP   18.     20.     25.
PC    0.      5.     12.     19.     29.     41.     58.     73.     87.     89.
PC   92.     96.     96.
DF   LR7      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     2.5     10.     14.    16.5    18.0    20.5    21.5    23.     24.
DF   LR8      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     1.5    8.75   11.25   13.25    16.0   18.25   19.75   21.0    22.5
DF   C10      12
DP     0      .5       1       2       3       4       5       6       7       8
DP     9      10
PC     0      12      27      49      64      77      85      89      93      94
PC    95      95
DC      MOBL HOM              MOBILE HOMES
DC      APARTMTS            3.0APARTMENTS
DC      S.F.RES.     5.0      SINGLE FAMILY RESIDENCE
DC        RESCON             RESIDENTIAL CONTENTS
DC      COMMERCL             COMMERCIAL
DC        COMCON             COMERCIAL CONTENTS
CC     3  RESCONMOBL HOMAPARTMTSS.F.RES.
CC     1  COMCONCOMMERCL
DR   DR1   494.5   493.5   494.5   492.3     485                      1
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
D3   10.     50.
DR   DR2   503.6   502.6   503.6   500.6     498     1.0              1
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
D3                  15.             25.
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
AC     4   RESID   RESID   RESID  RESCONCOMMERCL  COMCON
AR     1  AGRCH1  AGRCH1
SL   DR1MOBHOME1                    491.5   491.0
SD   DR1MOBHOME1MOBL HOMMH1  20.MH2   7.        MOBILE HOME
SL   DR1MOBHOME2                    491.3   489.0
SD   DR1MOBHOME2MOBL HOMMH1  15.MH2   5.        MOBILE HOME
SL   DR1MOBHOME3                    493.6   494.1
SD   DR1MOBHOME3MOBL HOMMH1  25.MH2  10.        MOBILE HOME
```

```
SL   DR1   APT01                    493.0   494.8           -10.         1
SD   DR1   APT01APARTMTSHR5 780.HR6 281.        13 APARTMENTS             (1SWB)
SO   DR1   APT01HR7 625.HR8 225.
SL   DR1   APT02                    494.2   493.7
SD   DR1   APT02APARTMTSHR5 880.HR6 325.        22 APARTMENTS        (COMPOSITE)
SL   DR2   RES01                    503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.        SINGLE FAMILY RESIDENCE   (1SNB)
SL   DR2   RES02                    503.5   503.0    -2.0                1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.         LR5  50.LR6  25.
SL   DR2   RES03                    503.8   504.5                    1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                        LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

J1 1 1 1 0 2 0 0 7 3 1

This job will perform the following

IPOL = 1, All structures within specified damage categories to be raised above target flood elevation

IPROF = 1, All structures within specified damage categories are flood proofed to target flood elevation

IEVAC = 1, All structures within specified damage categories will be relocated which have a reference elevation below the target flood elevation

IPRNT = 2, Suppress damage function printout

ITRACE = 0, No trace output

ITYPE = 7, Number of single events for which damage is calculated

IAG = 3, Aggregate damage categories and damage reaches for single event damage

ISAMP = 1, Sample by damage reach

EXHIBIT D-4

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Aggregated Category	Includes Damage Categories
RESID	MOBL HOM APARTMTS S.F.RES.
RESCON	RESCON
COMMERCL	COMMERCL
COMCON	COMCON
OTHER	OTHER

Aggregated Damage Reach	Includes Damage Reaches
AGRCH1	DR1 DR2

Structure I.D.= RES01 Ref. flood elev.= 503.40
SINGLE FAMILY RESIDENCE (1SNB) Structure reference elevation = 502.00
Damage reach DR2 Reference elev. at index = 502.60
Damage category S.F.RES.

		Structure	Contents	Other	Total
Total Value		50000.	25000.	0.	75000.
Damage Function		LR7	LR8		
Stage	Index Elev	Structure	Contents	Other	Total
.00	502.60	0.	0.	0.	0.
.50	503.10	0.	0.	0.	0.
1.00	503.60	0.	0.	0.	0.
1.50	504.10	6250.	5125.	0.	11375.
2.00	504.60	10000.	8750.	0.	18750.
2.50	505.10	12000.	10000.	0.	22000.
3.00	505.60	14000.	11250.	0.	25250.
3.50	506.10	15250.	12250.	0.	27500.
4.00	506.60	16500.	13250.	0.	29750.
4.50	507.10	17250.	14625.	0.	31875.
5.00	507.60	18000.	16000.	0.	34000.
5.50	508.10	19250.	17125.	0.	36375.
6.00	508.60	20500.	18250.	0.	38750.
6.50	509.10	21000.	19000.	0.	40000.
7.00	509.60	21500.	19750.	0.	41250.
7.50	510.10	22250.	20375.	0.	42625.
8.00	510.60	23000.	21000.	0.	44000.
8.50	511.10	23500.	21750.	0.	45250.
9.00	511.60	24000.	22500.	0.	46500.

2 YEAR					
-7.30	495.30	0.	0.	0.	0.
5 YEAR					
-3.80	498.80	0.	0.	0.	0.
10 YEAR					
-2.00	500.60	0.	0.	0.	0.
20 YEAR					
.00	502.60	0.	0.	0.	0.
50 YEAR					
1.00	503.60	0.	0.	0.	0.
100 YEAR					
5.10	507.70	18250.	16225.	0.	34475.
500 YEAR					
5.50	508.10	19250.	17125.	0.	36375.

Contents damage for this structure was placed in content category RESCON.

This structure was raised .40 feet.

The contents for this structure were raised .40 feet.

This structure was flood proofed to 503.60 feet (total of 1.00 feet with respect to zero damage point) to comply with flood proofing requirements.

The contents for this structure were flood proofed to 503.60 feet (total of 1.00 feet with respect to zero damage point) to comply with flood proofing requirements.

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Policy Summary

The following buildings were raised to comply with the encroachment policy

Building	amount raised
RES01	.40
1 Buildings were raised a total of	.40 feet

Flood Proofing Summary

The following buildings were flood proofed

Building	Amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10
3 Buildings were floodproofed a total of	4.60 feet

EXHIBIT D-4

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Content Adjustment Summary Table

Policy Summary

The contents for the following buildings were raised

Building	amount raised
RES01	.40

The contents for 1 buildings were raised a total of .40 feet

Flood Proofing Summary

The contents of the following buildings were floodproofed

Building	amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10

The contents for 3 buildings were flood proofed a total of 4.60 feet

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Policy Summary

The following buildings were raised to comply with the encroachment policy

Building	amount raised
RES01	.40
1 Buildings were raised a total of	.40 feet

Flood Proofing Summary

The following buildings were flood proofed

Building	Amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10
3 Buildings were floodproofed a total of	4.60 feet

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Content Adjustment Summary Table

Policy Summary

The contents for the following buildings were raised

Building	amount raised
RES01	.40

The contents for 1 buildings were raised a total of .40 feet

Flood Proofing Summary

The contents of the following buildings were floodproofed

Building	amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10

The contents for 3 buildings were flood proofed a total of 4.60 feet

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Policy Summary

The following buildings were raised to comply with the encroachment policy

Building	amount raised
RES01	.40
1 Buildings were raised a total of	.40 feet

Flood Proofing Summary

The following buildings were flood proofed

Building	Amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10
3 Buildings were floodproofed a total of	4.60 feet

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2

Content Adjustment Summary Table

Policy Summary

The contents for the following buildings were raised

Building	amount raised
RES01	.40

The contents for 1 buildings were raised a total of .40 feet

Flood Proofing Summary

The contents of the following buildings were floodproofed

Building	amount of flood proofing
RES01	1.00
RES02	2.50
COM01	1.10

The contents for 3 buildings were flood proofed a total of 4.60 feet

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR1
DRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
(Damages are in $1,000)

Damage Categories
(percent sampled)

Water Surface Elevation	MOBL HOM (10.0)	APARTMTS (50.0)	S.F.RES. (100.0)	RESCON (100.0)	COMMERCL (100.0)	COMCON (100.0)	OTHER (100.0)	(.0)	(.0)	(.0)	Total	
485.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
486.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
487.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
488.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
489.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
490.00	.0	148.1	.0	126.5	.0	.0	.0	.0	.0	.0	274.6	
491.00	.0	221.3	.0	191.3	.0	.0	.0	.0	.0	.0	412.5	
492.00	.0	296.3	.0	233.6	.0	.0	.0	.0	.0	.0	529.8	
492.30	.0	318.8	.0	243.0	.0	.0	.0	.0	.0	.0	561.8	EVCELV
493.00	.0	380.0	.0	265.1	.0	.0	.0	.0	.0	.0	645.1	
493.50	.8	417.5	.0	287.3	.0	.0	.0	.0	.0	.0	705.6	POLELV
494.00	1.6	445.6	.0	317.6	.0	.0	.0	.0	.0	.0	764.8	
494.50	6.8	473.8	.0	357.8	.0	.0	.0	.0	.0	.0	838.3	PROELV
495.00	12.0	510.7	.0	424.0	.0	.0	.0	.0	.0	.0	946.6	
496.00	26.7	624.2	.0	651.2	.0	.0	.0	.0	.0	.0	1302.0	
497.00	34.2	697.4	.0	780.1	.0	.0	.0	.0	.0	.0	1511.7	
498.00	37.9	773.2	.0	921.5	.0	.0	.0	.0	.0	.0	1732.6	
499.00	39.5	857.5	.0	1045.0	.0	.0	.0	.0	.0	.0	1942.0	
500.00	40.5	919.8	.0	1123.3	.0	.0	.0	.0	.0	.0	2083.6	
501.00	41.0	977.4	.0	1184.2	.0	.0	.0	.0	.0	.0	2202.5	
502.00	41.0	1011.9	.0	1231.1	.0	.0	.0	.0	.0	.0	2284.0	

(2 YEAR)											
* 485.30 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(5 YEAR)											
* 490.20 *	.0 *	161.9 *	.0 *	138.2 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	300.0 *
(10 YEAR)											
* 492.30 *	.0 *	318.8 *	.0 *	243.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	561.8 *
(20 YEAR)											
* 493.50 *	.8 *	417.5 *	.0 *	287.3 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	705.6 *
(50 YEAR)											
* 494.50 *	6.8 *	473.8 *	.0 *	357.8 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	838.3 *
(100 YEAR)											
* 495.50 *	19.4 *	568.4 *	.0 *	537.6 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1125.3 *
(500 YEAR)											
* 496.30 *	28.9 *	655.0 *	.0 *	697.4 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	1381.3 *

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category RESCON identified as RESIDENTIAL CONTENTS
Damage category COMMERCL identified as COMMERCIAL
Damage category COMCON identified as COMERCIAL CONTENTS
Damage category OTHER identified as OTHER DAMAGE CATEGORIES

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Damage Reach DR2
DRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
(Damages are in $1,000)

Water Surface Elevation	MOBL HOM (100.0)	APARTMTS (100.0)	S.F.RES. (15.0)	RESCON (100.0)	COMMERCL (25.0)	COMCON (100.0)	OTHER (100.0)	(.0)	(.0)	(.0)	Total	
	Damage Categories (percent sampled)											
498.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
499.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
500.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
500.60	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	EVCELV
501.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
502.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
502.60	.0	.0	.0	.0	.7	.0	.0	.0	.0	.0	.7	POLELV
503.00	.0	.0	.0	.0	3.6	.0	.0	.0	.0	.0	3.6	
503.60	.0	.0	.0	.0	8.8	.0	.0	.0	.0	.0	8.8	PROELV
504.00	.0	.0	29.2	106.8	239.4	456.0	.0	.0	.0	.0	831.4	
505.00	.0	.0	45.8	195.9	356.0	678.0	.0	.0	.0	.0	1275.7	
506.00	.0	.0	56.4	237.4	444.1	846.0	.0	.0	.0	.0	1583.9	
507.00	.0	.0	66.6	290.3	510.3	972.0	.0	.0	.0	.0	1839.3	
508.00	.0	.0	79.1	379.1	548.1	1044.0	.0	.0	.0	.0	2050.3	
509.00	.0	.0	89.0	429.7	573.3	1092.0	.0	.0	.0	.0	2184.1	
510.00	.0	.0	94.7	468.9	589.0	1122.0	.0	.0	.0	.0	2274.6	
511.00	.0	.0	100.2	509.3	595.3	1134.0	.0	.0	.0	.0	2338.9	
512.00	.0	.0	106.0	551.4	598.5	1140.0	.0	.0	.0	.0	2395.8	
513.00	.0	.0	108.4	575.5	598.5	1140.0	.0	.0	.0	.0	2422.4	
514.00	.0	.0	111.7	598.9	598.5	1140.0	.0	.0	.0	.0	2449.1	
515.00	.0	.0	114.5	631.9	598.5	1140.0	.0	.0	.0	.0	2484.9	

(2 YEAR)											
* 495.30 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(5 YEAR)											
* 498.80 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(10 YEAR)											
* 500.60 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *	.0 *
(20 YEAR)											
* 502.60 *	.0 *	.0 *	.0 *	.0 *	.7 *	.0 *	.0 *	.0 *	.0 *	.0 *	.7 *
(50 YEAR)											
* 503.60 *	.0 *	.0 *	.0 *	.0 *	8.8 *	.0 *	.0 *	.0 *	.0 *	.0 *	8.8 *
(100 YEAR)											
* 507.70 *	.0 *	.0 *	75.8 *	358.2 *	540.5 *	1029.6 *	.0 *	.0 *	.0 *	.0 *	2004.2 *
(500 YEAR)											
* 508.10 *	.0 *	.0 *	80.1 *	384.8 *	550.6 *	1048.8 *	.0 *	.0 *	.0 *	.0 *	2064.3 *

Damage category MOBL HOM identified as MOBILE HOMES
Damage category APARTMTS identified as APARTMENTS
Damage category S.F.RES. identified as SINGLE FAMILY RESIDENCE
Damage category RESCON identified as RESIDENTIAL CONTENTS
Damage category COMMERCL identified as COMMERCIAL
Damage category COMCON identified as COMERCIAL CONTENTS
Damage category OTHER identified as OTHER DAMAGE CATEGORIES

TEST 4 - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
SID - STRUCTURE INVENTORY OF DAMAGE
MARCH 1989

Aggregated Single Event Damage

Aggregated Damage Reach AGRCH1
Includes Damage Reaches
DR1 DR2

(Damage in $1,000)

Aggregated Damage Categories

Single Event	RESID	RESCON	COMMERCL	COMCON	OTHER						Total
2 YEAR	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5 YEAR	323.8	138.2	.0	.0	.0	.0	.0	.0	.0	.0	461.9
10 YEAR	637.5	243.0	.0	.0	.0	.0	.0	.0	.0	.0	880.5
20 YEAR	843.0	287.3	2.9	.0	.0	.0	.0	.0	.0	.0	1133.1
50 YEAR	1015.5	357.8	35.0	.0	.0	.0	.0	.0	.0	.0	1408.3
100 YEAR	1835.7	895.8	2162.2	1029.6	.0	.0	.0	.0	.0	.0	5923.2
500 YEAR	2133.1	1082.2	2202.5	1048.8	.0	.0	.0	.0	.0	.0	6466.6

Aggregated Category	Includes damage categories
RESID	MOBL HOM APARTMTS S.F.RES.
RESCON	RESCON
COMMERCL	COMMERCL
COMCON	COMCON
OTHER	OTHER

EXHIBIT D-5

SID-EAD Program Interface
Expected Annual Damage Computations

Exhibit D-5.
SID-EAD Program Interface-Expected Annual Damage Computations

Problem Statement

This problem demonstrates the automatic interface of the SID and EAD computer programs to determine expected annual damage values by damage category and reach. The damage reduced by implementing a plan may be evaluated by: (1) determination of the "without" conditions elevation-damage functions (SID); (2) determination of the "with" conditions elevation-damage functions; and (3) subsequent interface of the SID-generated elevation-damage functions with corresponding hydrologic and hydraulic data to calculate the expected annual damage reduction (EAD program). Steps 1 and 2 require individual program executions of the SID program with the output stored in the HECDSS. Step 3 is the retrieval of these data by the EAD program and subsequent evaluation of the "with" and "without" conditions to obtain the damage reduction values.

The problems of Exhibits D-2 and D-3 are used to generate the "without" and "with" conditions, respectively.

Description of Input Requirements

The key variables for step 1 in creating the "without" condition analysis results and output files are IPOL (J1.1), IPROF (J1.2), and IEVAC (J1.3). The ZW record indicates that the elevation-damage functions are to be written to a DSS file for later retrieval by EAD. The fields on the ZW record comprise the DSS pathname. The maximum number of elevations possible, IELV (J2.7), is 18. A maximum of 50 damage categories (NODC) may be output from SID to DSS; the EAD program must aggregate any more than 18 damage categories to a maximum of 18.

Step 2 requires similar variable values as described in the problem in Exhibit D-4 to specify the nonstructural analyses to be performed for the "with" condition. The ZW record would be required as above. The ZW record defines the appropriate pathname for the "with" conditions.

Step 3 involves the access by the EAD program of the output SID files and the interface of these data with hydrologic and hydraulic information to yield expected annual damage values. The key variables are: NMCAT (CN) with damage categories in the same order as the DC records in SID and the ZR record (for each alternative) having the exact pathname as the ZW record of SID.

Description of Results

The SID output is similar to that as described in Exhibits D-2 and D-3 for "without" and "with" conditions, respectively. The elevation-damage functions by damage category and reach are automatically stored in a DSS file for use by the EAD program. The EAD User's Manual may be used to describe the enclosed EAD program results.

List of Input Records for This Run

```
T1              TEST 5A - EXISTING CONDITION ANALYSIS
T2               SID - STRUCTURE INVENTORY OF DAMAGE
T3                          MARCH 1989
J1                                                                  7              1
J2    15       6       2     1.0                 2      18        1
ZW A=SID TEST    E=1982   F=EXISTING CONDITIONS
DF   MH1       9
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.
PC    0.      8.     50.     71.     82.     87.     89.     91.     91.
DF   MH2      10
DP   -1.      0.      1.      2.      3.      4.      5.      6.      7.      8.
PC    0.      3.     30.     56.     72.     79.     84.     87.     88.     90.
DF   HR5      20
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       1       8      14      18      22      25      28      29      30
PC   32      36              45      48      51      54      57      60      63
DF   HR6      20
DP    0       1               3       4       5       6       7       8       9
DP   10      11      12      13      14      15      16      17      18      19
PC    0       4      23      32      38      45      50      53      55      55
PC   55      58      63      65      72      77      82      87     100     100
DF   HR7      12
DP    0       1       2       3       4       5       6       7       8       9
DP   10      11
PC    0       4       9      16      27      39      51      65      74      83
PC   91      91
DF   HR8      10
DP    0       1       2       3       4       5       7       9      10      11
PC    0       6      11      19      32      47      61      87     100     100
DF   LR1      10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      5.     20.     28.     33.     36.     41.     43.     46.     48.
DF   LR2      10
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
PC    0.      6.     35.     45.     53.     64.     73.     79.     84.     90.
DF   LR3      12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.      4.6    11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC  67.9    67.9
DF   LR4      12
DP  -10.     -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP    0.      1.
PC    0.      5.7    13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
PC  100.    100.
DF   LR5      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17.
```

```
DP   18.     20.     25.
PC    0.      2.      4.      7.      9.     12.     14.     17.     20.     25.
PC   32.     43.     59.
DF   LR6      13
DP    8.      9.     10.     11.     12.     13.     14.     15.     16.     17
DP   18.     20.     25.
PC    0.      5.     12.     19.     29.     41.     58.     73.     87.     89.
PC   92.     96.     96.
DF   LR7      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     2.5     10.     14.    16.5    18.0    20.5    21.5    23.     24.
DF   LR8      10       1
DP    0.      1.      2.      3.      4.      5.      6.      7.      8.      9.
DD    0.     1.5    8.75   11.25   13.25   16.0    18.25   19.75   21.0    22.5
DF   C10      12
DP     0      .5       1       2       3       4       5       6       7       8
DP     9      10
PC     0      12      27      49      64      77      85      89      93      94
PC    95      95
DC      MOBL HOM              MOBILE HOMES
DC      APARTMTS              APARTMENTS
DC      S.F.RES.              SINGLE FAMILY RESIDENCE
DC        RESCON              RESIDENTIAL CONTENTS
DC      COMMERCL              COMMERCIAL
DC        COMCON              COMMERCIAL CONTENTS
CC     3  RESCONMOBL HOMAPARTMTSS.F.RES.
CC     1  COMCONCOMMERCL
DR   DR1   494.5                              485                      1
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
D3   10.     50.
DR   DR2   503.6                              498                      1
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
D3                  15.             25.
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
SL   DR1MOBHOME1                    491.5   491.0
SD   DR1MOBHOME1MOBL HOMMH1  20.MH2   7.        MOBILE HOME
SL   DR1MOBHOME2                    491.3   489.0
SD   DR1MOBHOME2MOBL HOMMH1  15.MH2   5.        MOBILE HOME
SL   DR1MOBHOME3                    493.6   494.1
SD   DR1MOBHOME3MOBL HOMMH1  25.MH2  10.        MOBILE HOME
SL   DR1   APT01                    493.0   494.8          -10.         1
SD   DR1   APT01APARTMTSHR5 780.HR6 281.        13 APARTMENTS             (1SWB)
SO   DR1   APT01HR7 625.HR8 225.
SL   DR1   APT02                    494.2   493.7
SD   DR1   APT02APARTMTSHR5 880.HR6 325.        22 APARTMENTS        (COMPOSITE)
SL   DR2   RES01                    503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.        SINGLE FAMILY RESIDENCE   (1SNB)
SL   DR2   RES02                    503.5   503.0    -2.0                1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.        LR5  50.LR6  25.
```

```
SL   DR2   RES03                    503.8   504.5                    1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                        LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

All output for SID analysis of "without" conditions is deleted except for that which is pertinent to HECDSS linkages between SID and EAD. See Exhibit D-2 for selected SID output.

```
              TEST 5A - EXISTING CONDITION ANALYSIS
               SID - STRUCTURE INVENTORY OF DAMAGE
                          MARCH 1989


HECDSS File System Information - Aggregated elevation - damage data will
be written to a HECDSS (HEC Data Storage System) file.
------------------------------------------------------------------------
Project  (pathname part A).....SID TEST
Alternative (pathname part F).....EXISTING CONDITIONS
Year (pathname part E).....1982


** HECDSS File System Initialization **
   -----DSS---ZOPEN; Existing File Opened - Unit:  71  File: SAMPLE5.DSS

** HECDSS Data File Opened: SAMPLE5.DSS
```



```
              TEST 5A - EXISTING CONDITION ANALYSIS
               SID - STRUCTURE INVENTORY OF DAMAGE
                          MARCH 1989


-----DSS---ZWRITE Unit  71; Vers.    2:  /SID TEST/DR1/ELEVATION-DAMAGE//1982/EXISTING CONDITIONS/
-----DSS---ZWRITE Unit  71; Vers.    2:  /SID TEST/DR2/ELEVATION-DAMAGE//1982/EXISTING CONDITIONS/
   -----DSS---ZCLOSE Unit: 71
              Number of Records:      4
              File Size:      5.6  Kbytes
              Percent Inactive:   .00
```

List of Input Records for This Run

```
T1 TEST 5B - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
T2                SID - STRUCTURE INVENTORY OF DAMAGE
T3                              MARCH 1989
J1     1       1       1                2                       7       3       1
J2    15       6       2     1.0                2                 1
J3      1S.F.RES.
J5      3APARTMTSCOMMERCLS.F.RES.
J8      2MOBL HOMS.F.RES.
ZW A=SID TEST     E=1982    F=WITH ACTION CONDITION
DF    MH1       9
DP    -1.       0.      1.      2.      3.      4.      5.      6.      7.
PC     0.       8.     50.     71.     82.     87.     89.     91.     91.
DF    MH2      10
DP    -1.       0.      1.      2.      3.      4.      5.      6.      7.      8.
PC     0.       3.     30.     56.     72.     79.     84.     87.     88.     90.
DF    HR5      20
DP     0        1       2       3       4       5       6       7       8       9
DP    10       11      12      13      14      15      16      17      18      19
PC     0        1       8      14      18      22      25      28      29      30
PC    32       36      41      45      48      51      54      57      60      63
DF    HR6      20
DP     0        1       2       3       4       5       6       7       8       9
DP    10       11      12      13      14      15      16      17      18      19
PC     0        4      23      32      38      45      50      53      55      55
PC    55       58      63      65      72      77      82      87     100     100
DF    HR7      12
DP     0        1       2       3       4       5       6       7       8       9
DP    10       11
PC     0        4       9      16      27      39      51      65      74      83
PC    91       91
DF    HR8      10
DP     0        1       2       3       4       5       7       9      10      11
PC     0        6      11      19      32      47      61      87     100     100
DF    LR1      10
DP     0.       1.      2.      3.      4.      5.      6.      7.      8.      9.
PC     0.       5.     20.     28.     33.     36.     41.     43.     46.     48.
DF    LR2      10
DP     0.       1.      2.      3.      4.      5.      6.      7.      8.      9.
PC     0.       6.     35.     45.     53.     64.     73.     79.     84.     90.
DF    LR3      12
DP   -10.      -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP     0.       1.
PC     0.      4.6     11.2    16.4    21.3    28.6    33.3    42.7    54.2    63.9
PC   67.9     67.9
DF    LR4      12
DP   -10.      -9.     -8.     -7.     -6.     -5.     -4.     -3.     -2.     -1.
DP     0.       1.
PC     0.      5.7     13.6    15.7    21.3    33.3    56.9    69.7    82.5    94.8
```

```
PC  100.    100.
DF   LR5     13
DP    8.     9.    10.    11.    12.    13.    14.    15.    16.    17.
DP   18.    20.    25.
PC    0.     2.     4.     7.     9.    12.    14.    17.    20.    25.
PC   32.    43.    59.
DF   LR6     13
DP    8.     9.    10.    11.    12.    13.    14.    15.    16.    17
DP   18.    20.    25.
PC    0.     5.    12.    19.    29.    41.    58.    73.    87.    89.
PC   92.    96.    96.
DF   LR7     10      1
DP    0.     1.     2.     3.     4.     5.     6.     7.     8.     9.
DD    0.    2.5    10.    14.   16.5   18.0   20.5   21.5   23.    24.
DF   LR8     10      1
DP    0.     1.     2.     3.     4.     5.     6.     7.     8.     9.
DD    0.    1.5   8.75  11.25  13.25   16.0  18.25  19.75   21.0   22.5
DF   C10     12
DP     0     .5      1      2      3      4      5      6      7      8
DP     9     10
PC     0     12     27     49     64     77     85     89     93     94
PC    95     95
DC     MOBL HOM              MOBILE HOMES
DC     APARTMTS            3.0APARTMENTS
DC     S.F.RES.     5.0      SINGLE FAMILY RESIDENCE
DC       RESCON              RESIDENTIAL CONTENTS
DC     COMMERCL              COMMERCIAL
DC       COMCON              COMERCIAL CONTENTS
CC    3  RESCONMOBL HOMAPARTMTSS.F.RES.
CC    1  COMCONCOMMERCL
DR  DR1   494.5   493.5   494.5   492.3     485                      1
DTDRY CREEK DAM. REACH 1 STA 162-65 TO 170-00
SE 485.3   490.2   492.3   493.5   494.5   495.5   496.3
D3  10.     50.
DR  DR2   503.6   502.6   503.6   500.6     498     1.0              1
DTDRY CREEK DAM. REACH STA 178-00 TO 189-50IND.185-00
SE 495.3   498.8   500.6   502.6   503.6   507.7   508.1
D3                 15.              25.
ST2 YEAR  5 YEAR 10 YEAR 20 YEAR 50 YEAR100 YEAR500 YEAR
AC    4   RESID   RESID   RESID  RESCONCOMMERCL  COMCON
AR    1  AGRCH1  AGRCH1
SL  DR1MOBHOME1                   491.5   491.0
SD  DR1MOBHOME1MOBL HOMMH1  20.MH2   7.       MOBILE HOME
SL  DR1MOBHOME2                   491.3   489.0
SD  DR1MOBHOME2MOBL HOMMH1  15.MH2   5.       MOBILE HOME
SL  DR1MOBHOME3                   493.6   494.1
SD  DR1MOBHOME3MOBL HOMMH1  25.MH2  10.       MOBILE HOME
SL  DR1   APT01                   493.0   494.8           -10.       1
SD  DR1   APT01APARTMTSHR5 780.HR6 281.       13 APARTMENTS           (1SWB)
SO  DR1   APT01HR7 625.HR8 225.
SL  DR1   APT02                   494.2   493.7
SD  DR1   APT02APARTMTSHR5 880.HR6 325.       22 APARTMENTS       (COMPOSITE)
```

```
SL   DR2   RES01                    503.4   502.0
SD   DR2   RES01S.F.RES.LR7  50.LR8  25.        SINGLE FAMILY RESIDENCE   (1SNB)
SL   DR2   RES02                    503.5   503.0    -2.0                  1
SD   DR2   RES02S.F.RES.LR1  75.LR2  30.        SINGLE FAMILY RESIDENCE   (2SWB)
SO   DR2   RES02LR3  30.LR4  10.        LR5  50.LR6  25.
SL   DR2   RES03                    503.8   504.5                    1.5 1
SD   DR2   RES03S.F.RES.LR1  60.LR2  30.        SINGLE FAMILY RESIDENCE   (2SNB)
SO   DR2   RES03                         LR5  40.LR6  20.
SL   DR2   COM01                    503.7   502.6
SD   DR2   COM01COMMERCLC10 600.    -50.     -5.BANK AND TRUST
ES
```

All output for SID analysis of "with" conditions is deleted except for that which is pertinent to HECDSS linkages between SID and EAD. See Exhibit D-3 for selected SID output.

```
 TEST 5B - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
             SID - STRUCTURE INVENTORY OF DAMAGE
                         MARCH 1989


HECDSS File System Information - Aggregated elevation - damage data will
be written to a HECDSS (HEC Data Storage System) file.
--------------------------------------------------------------------------------
Project  (pathname part A).....SID TEST
Alternative (pathname part F).....WITH ACTION CONDITION
Year (pathname part E).....1982


** HECDSS File System Initialization **
   -----DSS---ZOPEN; Existing File Opened - Unit:  71  File: SAMPLE5.DSS

** HECDSS Data File Opened: SAMPLE5.DSS
```



```
 TEST 5B - RAISING , FLOOD PROOFING , AND RELOCATION OF STRUCTURES
             SID - STRUCTURE INVENTORY OF DAMAGE
                         MARCH 1989


-----DSS---ZWRITE Unit  71; Vers.    2:  /SID TEST/DR1/ELEVATION-DAMAGE//1982/WITH ACTION CONDITION/
-----DSS---ZWRITE Unit  71; Vers.    2:  /SID TEST/DR2/ELEVATION-DAMAGE//1982/WITH ACTION CONDITION/
   -----DSS---ZCLOSE Unit: 71
             Number of Records:      4
             File Size:      5.6  Kbytes
             Percent Inactive:   .00
```

```
++++++++++++++++++++++++++++++++++++++++++++
+ Expected Annual Flood Damage Computation +
+ 761-X6-L7580      IBM-PC Compatible      +
+ Version Date      December 1, 1988       +
++++++++++++++++++++++++++++++++++++++++++++


** LIST OF RECORDS READ BY READIN **
RECORD
 ORDER          1         2         3         4         5         6         7         8
NUMBER 12345678901234567890123456789012345678901234567890123456789012345678901234567890

     1 TT  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
     2 TT  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
     3 TT  INSERTED INTO THE EAD INPUT FILE.
     4 TT  DAMAGE VALUES IN THOUSAND DOLLARS
     5 TT  MARCH 1989
     6 CN      7MOBL HOMAPARTMTSS.F.RES.  RESCONCOMMERCL  COMCON   OTHER
     7 PN      1  EXISTING CONDITIONS WITHIN THE BASIN
     8 PN      2  RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES
     9 DY      1    1982
    10 RNDAMAGE REACH 1
    11 FR              7      50      20      10       5       2       1     0.2
    12 SF   DR11981       485.3   490.2   492.3   493.5   494.5   495.5   496.3
    13 ZR A=SID TEST B=DR1 C=ELEVATION-DAMAGE E=1982 F=EXISTING CONDITIONS
    14 EP      1
    15 ZR C=SD F=WITH ACTION CONDITION
    16 ER      2
    17 RNDAMAGE REACH 2
    18 SFDR2   1982       495.3   498.8   500.6   502.6   503.6   507.7   508.1
    19 ZR B=DR2 C=SD F=EXISTING CONDITIONS
    20 EP      1
    21 ZR C=SD F=WITH ACTION CONDITION
    22 EJ      2


READIN --     22 RECORDS WRITTEN TO LOGICAL FILE  8
```

```
++++++++++++++++++++++++++++++++++++++++++++
+ Expected Annual Flood Damage Computation +
+ 761-X6-L7580     IBM-PC Compatible       +
+ Version Date     December 1, 1988        +
++++++++++++++++++++++++++++++++++++++++++++


TT  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
TT  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
TT  INSERTED INTO THE EAD INPUT FILE.
TT  DAMAGE VALUES IN THOUSAND DOLLARS
TT  MARCH 1989

**DAMAGE CATEGORY NAMES**
CN   7  MOBL HOMAPARTMTSS.F.RES.  RESCONCOMMERCL  COMCON   OTHER

**FLOOD PLAIN MANAGEMENT PLAN NAMES**
PN   1    EXISTING CONDITIONS WITHIN THE BASIN
PN   2    RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

**INPUT DATA YEARS**
     NDYRS   IDYRS
DY       1    1982

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++


REACH   1, REACH NAME -
RNDAMAGE REACH 1

++++ INPUT DATA ++++

**FREQUENCIES**
FR            7   50.00   20.00   10.00    5.00    2.00    1.00     .20

**** CAUTION -- INPUT DATA YEAR OF 1981 NOT ON DY RECORD.
SET TO NEAREST YEAR OF 1982

**FLOOD STAGES**
SF   DR11982 0    485.30  490.20  492.30  493.50  494.50  495.50  496.30
   -----DSS---ZOPEN; Existing File Opened - Unit:  71  File: SAMPLE5.DSS

** HECDSS DATA FILE OPENED: SAMPLE5.DSS

** STAGES FOR DAMAGE DATA READ FROM HECDSS FILE **
SD   DR1      18  485.00  486.00  487.00  488.00  489.00  490.00  491.00  492.00
  493.00  494.00  495.00  496.00  497.00  498.00  499.00  500.00  501.00  502.00
```

```
** FLOOD DAMAGE DATA READ FROM HECDSS FILE **

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  1   (MOBL HOM)
DG   DR11982 0 1      0.      0.      0.      0.      0.      0.      0.     10.
     62.    116.    240.    396.    474.    515.    532.    541.    546.    546.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  2   (APARTMTS)
DG   DR11982 0 2      0.      0.     35.     94.    174.    296.    443.    593.
    760.    891.   1021.   1248.   1395.   1546.   1715.   1840.   1955.   2024.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  3   (S.F.RES.)
DG   DR11982 0 3      0.      0.      0.      0.      0.      0.      0.      0.
      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  4   (  RESCON)
DG   DR11982 0 4      0.      0.     19.     43.     75.    126.    191.    235.
    277.    343.    458.    690.    822.    965.   1089.   1168.   1229.   1276.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  5   (COMMERCL)
DG   DR11982 0 5      0.      0.      0.      0.      0.      0.      0.      0.
      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  6   (  COMCON)
DG   DR11982 0 6      0.      0.      0.      0.      0.      0.      0.      0.
      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  7   (   OTHER)
DG   DR11982 0 7      0.      0.      0.      0.      0.      0.      0.      0.
      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

**END OF INPUT DATA FOR PLAN  1 **
EP++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++DAMAGE DATA FOR PLAN 1 --   EXISTING CONDITIONS WITHIN THE BASIN

       FREQ      FLOW     STAGE  MOBL HOM  APARTMTS  S.F.RES.    RESCON  COMMERCL    COMCON     OTHER     TOTAL   ACC EAD
   1  50.00       -1.    485.30       .00       .00       .00       .00       .00       .00       .00       .00    244.87
   2  20.00       -1.    490.20       .00    325.50       .00    139.41       .00       .00       .00    464.92    201.61
   3  10.00       -1.    492.30     25.44    642.75       .00    247.53       .00       .00       .00    915.72    133.82
   4   5.00       -1.    493.50     89.30    825.63       .00    310.15       .00       .00       .00   1225.08     80.46
   5   2.00       -1.    494.50    177.95    956.30       .00    400.65       .00       .00       .00   1534.90     40.12
   6   1.00       -1.    495.50    317.85   1134.83       .00    574.15       .00       .00       .00   2026.83     22.75
   7    .20       -1.    496.30    419.52   1292.26       .00    729.45       .00       .00       .00   2441.23      4.88

EXP ANNUAL DAMAGE                   13.03    163.48       .00     68.36       .00       .00       .00    244.87
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
REACH   1, REACH NAME -
RNDAMAGE REACH 1

++++ INPUT DATA ++++

WARNING, TOO MANY POINTS IN DAMAGE RELATIONSHIP STORED IN HECDSS FILE
LIMITED TO:  18 POINTS
RELATIONSHIP TRUNCATED

** STAGES FOR DAMAGE DATA READ FROM HECDSS FILE **
SD   DR1      21  485.00  486.00  487.00  488.00  489.00  490.00  491.00  492.00
  492.30  493.00  493.50  494.00  494.50  495.00  496.00  497.00  498.00  499.00
  500.00  501.00  502.00

** FLOOD DAMAGE DATA READ FROM HECDSS FILE **

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  1   (MOBL HOM)
DG   DR11982 0 1      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      8.     16.     68.    120.    267.    342.    379.    396.
   405.    410.    410.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  2   (APARTMTS)
DG   DR11982 0 2      0.      0.      0.      0.      0.    296.    443.    593.
   638.    760.    835.    891.    948.   1021.   1248.   1395.   1546.   1715.
  1840.   1955.   2024.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  3   (S.F.RES.)
DG   DR11982 0 3      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  4   (  RESCON)
DG   DR11982 0 4      0.      0.      0.      0.      0.    126.    191.    234.
   243.    265.    287.    318.    358.    424.    651.    780.    922.   1045.
  1123.   1184.   1231.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  5   (COMMERCL)
DG   DR11982 0 5      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.

DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  6   (  COMCON)
DG   DR11982 0 6      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.
```

```
DATA BELOW WILL BE AGGREGATED TO DAMAGE CATEGORY  7   (   OTHER)
DG   DR11982 0 7      0.      0.      0.      0.      0.      0.      0.      0.
       0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
       0.      0.      0.

**END OF INPUT DATA FOR PLAN  2 **
ER++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

++DAMAGE DATA FOR PLAN 2 -- RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

	FREQ	FLOW	STAGE	MOBL HOM	APARTMTS	S.F.RES.	RESCON	COMMERCL	COMCON	OTHER	TOTAL	ACC EAD
1	50.00	-1.	485.30	.00	.00	.00	.00	.00	.00	.00	.00	207.34
2	20.00	-1.	490.20	.00	325.50	.00	139.41	.00	.00	.00	464.92	190.81
3	10.00	-1.	492.30	.00	637.50	.00	243.00	.00	.00	.00	880.50	123.58
4	5.00	-1.	493.50	8.00	835.00	.00	287.25	.00	.00	.00	1130.25	73.54
5	2.00	-1.	494.50	68.00	947.50	.00	357.75	.00	.00	.00	1373.25	36.87
6	1.00	-1.	495.50	193.50	1134.83	.00	537.55	.00	.00	.00	1865.88	21.09
7	.20	-1.	496.30	289.35	1292.26	.00	689.84	.00	.00	.00	2271.45	4.54
EXP ANNUAL DAMAGE				4.49	145.05	.00	57.79	.00	.00	.00	207.34	

```
 TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
 SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
 INSERTED INTO THE EAD INPUT FILE.


** SUMMARY OF REACH NAMES  **

 NO     ID    . . NAME . . .
-------------------------------------------------------------------------
  1    DR1    DAMAGE REACH 1
  2    DR2    DAMAGE REACH 2

-------------------------------------------------------------------------
```


```
 TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
 SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
 INSERTED INTO THE EAD INPUT FILE.
```


```
** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
         1 -   EXISTING CONDITIONS WITHIN THE BASIN
         2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY  1 - MOBL HOM
  FOR INPUT DATA YEAR 1982
-------------------------------------
            .EXPECTED ANNUAL DAMAGE
   REACH      BASE     .... PLAN  2....
 NO    ID   CONDITION  DAMAGE    DAMAGE
            (PLAN  1)  W/PLAN   REDUCED
-------------------------------------
  1    DR1      13.03      4.49      8.53
  2    DR2        .00       .00       .00
-------------------------------------

  MOBL HOM      13.03      4.49      8.53

-------------------------------------
```

TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
INSERTED INTO THE EAD INPUT FILE.

** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS = 1982

** FLOOD PLAIN MANAGEMENT PLANS
1 - EXISTING CONDITIONS WITHIN THE BASIN
2 - RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY 2 - APARTMTS
FOR INPUT DATA YEAR 1982

REACH NO	REACH ID	.EXPECTED ANNUAL DAMAGE BASE CONDITION (PLAN 1)	.... PLAN 2.... DAMAGE W/PLAN	DAMAGE REDUCED
1	DR1	163.48	145.05	18.43
2	DR2	.00	.00	.00
APARTMTS		163.48	145.05	18.43

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
  INSERTED INTO THE EAD INPUT FILE.


** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
         1 -   EXISTING CONDITIONS WITHIN THE BASIN
         2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY  3 - S.F.RES.
  FOR INPUT DATA YEAR 1982
---------------------------------------
            .EXPECTED ANNUAL DAMAGE
   REACH       BASE     .... PLAN  2....
 NO     ID   CONDITION  DAMAGE    DAMAGE
             (PLAN  1)  W/PLAN   REDUCED
---------------------------------------
  1    DR1        .00       .00       .00
  2    DR2      16.32      8.29      8.04
---------------------------------------

  S.F.RES.      16.32      8.29      8.04

---------------------------------------
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
  INSERTED INTO THE EAD INPUT FILE.


** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
         1 -   EXISTING CONDITIONS WITHIN THE BASIN
         2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY  4 -   RESCON
  FOR INPUT DATA YEAR 1982
---------------------------------------
            .EXPECTED ANNUAL DAMAGE
   REACH      BASE     .... PLAN  2....
 NO    ID   CONDITION  DAMAGE   DAMAGE
            (PLAN  1)  W/PLAN  REDUCED
---------------------------------------
  1    DR1    68.36     57.79    10.57
  2    DR2     9.85      5.69     4.15
---------------------------------------

    RESCON    78.21     63.49    14.72

---------------------------------------
```

* *
* *

TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
INSERTED INTO THE EAD INPUT FILE.

** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS = 1982

** FLOOD PLAIN MANAGEMENT PLANS

1 - EXISTING CONDITIONS WITHIN THE BASIN
2 - RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY 5 - COMMERCL
FOR INPUT DATA YEAR 1982

REACH		.EXPECTED ANNUAL DAMAGE		
		BASE	.... PLAN	2....
NO	ID	CONDITION (PLAN 1)	DAMAGE W/PLAN	DAMAGE REDUCED
1	DR1	.00	.00	.00
2	DR2	48.55	36.51	12.05
COMMERCL		48.55	36.51	12.05

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
  INSERTED INTO THE EAD INPUT FILE.

** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
         1 -   EXISTING CONDITIONS WITHIN THE BASIN
         2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

SUMMARY FOR DAMAGE CATEGORY  6 -   COMCON
  FOR INPUT DATA YEAR 1982
---------------------------------------
             .EXPECTED ANNUAL DAMAGE
   REACH       BASE     .... PLAN  2....
 NO    ID   CONDITION  DAMAGE   DAMAGE
            (PLAN  1)  W/PLAN  REDUCED
---------------------------------------
  1    DR1       .00      .00      .00
  2    DR2     23.12    17.13     5.99
---------------------------------------

    COMCON     23.12    17.13     5.99

---------------------------------------
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

  TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
  SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
  INSERTED INTO THE EAD INPUT FILE.


** EXPECTED ANNUAL DAMAGE SUMMARY BY REACH **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
        1 -   EXISTING CONDITIONS WITHIN THE BASIN
        2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

GRAND SUMMARY - ALL DAMAGE CATEGORIES
  FOR INPUT DATA YEAR 1982
--------------------------------------
            .EXPECTED ANNUAL DAMAGE
   REACH      BASE     .... PLAN  2....
 NO    ID   CONDITION  DAMAGE   DAMAGE
            (PLAN  1)  W/PLAN  REDUCED
--------------------------------------
  1    DR1    244.87   207.34    37.53
  2    DR2     97.84    67.62    30.22
--------------------------------------

      TOTAL   342.71   274.96    67.75

--------------------------------------
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

 TEST NO. 3 -- RETRIEVAL OF DATA FROM THE HEC DATA STORAGE SYSTEM
 SID DAMAGE DATA FOR TWO PLANS ARE AUTOMATICALLY RETRIEVED AND
 INSERTED INTO THE EAD INPUT FILE.


** GRAND SUMMARY BY CATEGORY **

** INPUT DATA YEARS   =  1982

** FLOOD PLAIN MANAGEMENT PLANS
         1 -   EXISTING CONDITIONS WITHIN THE BASIN
         2 -   RAISING, FLOOD PROOFING, AND RELOCATION OF STRUCTURES

GRAND SUMMARY - ALL DAMAGE CATEGORIES
  FOR INPUT DATA YEAR 1982
--------------------------------------
            .EXPECTED ANNUAL DAMAGE
  DAMAGE      BASE     .... PLAN  2....
 CATEGORY  CONDITION  DAMAGE   DAMAGE
            (PLAN  1)  W/PLAN   REDUCED
--------------------------------------
  MOBL HOM    13.03     4.49     8.53
  APARTMTS   163.48   145.05    18.43
  S.F.RES.    16.32     8.29     8.04
    RESCON    78.21    63.49    14.72
  COMMERCL    48.55    36.51    12.05
    COMCON    23.12    17.13     5.99
     OTHER      .00      .00      .00
--------------------------------------

     TOTAL   342.71   274.96    67.75

--------------------------------------


READIN --  NO RECORDS READ FROM USER INPUT


++++++++++++++++
END OF RUN
EAD PROGRAM STOP
++++++++++++++++
   -----DSS---ZCLOSE Unit: 71
              Number of Records:      4
              File Size:      5.6  Kbytes
              Percent Inactive:   .00
```

APPENDIX E

Input Description

Summary of Records

Input Description

This exhibit provides a detailed description of the SID data input requirements, by record and data variable. Previous versions of this document referred to each data record as a card. The majority of new users no longer use cards but instead use utility programs, such as text editors, word processors, or spreadsheets, to produce the input data file for their programs. The term "card" in the original document has been changed to the term "record" in this version. Each record in the SID program is the equivalent of a line to a text editor program, a line with carriage return to a word processing program, or a row to a spreadsheet program.

Each record contains 11 fields, field 0 through field 10. Field 0 (zero) refers to column positions 1 and 2 and is reserved for the record identifier. Field 1 ranges from column 3-8; fields 2-10 contain eight columns each (9-16, 17-24,...,73-80). The field number designates the location of the variable on each input record. An abbreviated field location nomenclature is used to identify the field location. The record name is followed by a decimal point and the field number. For example, J1.3 refers to the third field on the J1 record. A field on a record may contain data in only a part of the field. In those cases, the location is referred to as columns, shown in parentheses. For example, field 6 on the ZW record contains the variable IYR in columns 45-48.

All variables beginning with I, J, K, L, M, and N should have integer values (no decimal point) and be right-justified (the values shifted to the right within each field). A "+" sign under the value heading indicates the placement of a positive numerical value in the field. A "-" sign indicates a negative numerical value in that field. "AN" means that a combination of alphanumeric characters is allowed. When a number does not have sign, a positive value will be assumed. In general, input values, both numerical and alphanumeric, should be right-justified in their fields.

T1
T2
T3

TITLE RECORDS

T1, T2, T3, RECORDS (Required)

These required records provide up to three lines of information at the top of each page of output.

Field	Variable	Value	Description
0	KODE	T1, T2, or T3	Record identification. (3 records)
1-10	TITLE	AN	Title information (center of title falls in record column 41).

JOB RECORDS

J1 RECORD (Required)

This required record specifies the analysis to be performed, printout option, and the file management option.

Field	Varible	Value	Description
0	KODE	J1	Record identification.
1	IPOL	0	No raise-to-target elevation analysis to be considered in this computer run.
		1	All structures are to be analyzed. Zero stage of all structures within specified damage categories to be raised to designated flood level (J3 and DR records).
		2	Only new structures are to be analyzed. Zero stage of all structures within specified damage categories to be raised to designated flood level (J3 and DR records).
		3	All structures within designated damage categories are to be raised a specified amount (J3 and JA records).
		4	Only new structures within designated damage categories are to be raised specified amount (J3 and JA records).
		5	Only specified structures are to be analyzed. Each designated structure is raised a specified amount, or to a target flood level. Based on zero stage (J4 and DR records).
2	IPROF	0	No flood proofing to be considered in this computer run.
		1	All structures within designated damage categories are flood proofed to specified target flood level (J5 and DR records).
		2	Only new structures are to be analyzed. All structures within designated damage categories are flood proofed to specified target flood level (J5 and DR records).
		3	All structures within designated damage categories are flood proofed to a specified height with respect to zero damage (J5 and J6 records).
		4	Only new structures are to be analyzed. All structures within designated damage categories are flood proofed to a specified height with respect to zero damage (J5 and J6 records).
		5	Only specified structures are to be analyzed. Each designated structure is flood proofed to a specified height or to target flood level as designated on J7 and DR records.

J1

J1 RECORD (continued)

FIELD	VARIABLE	VALUE	DESCRIPTION
3	IEVAC	0	No structure relocation to be considered for this computer run.
		1	Relocate all structures within designated damage categories which have a reference elevation below the specified flood level for implementation (J8 and DR records).
		2	Only new structures are to be analyzed. Relocate all structures within designated damage categories which have reference elevation below the specified flood level for implementation (J8 and DR records).
		3	Relocate all structures within designated damage categories which have a zero damage elevation below the specified flood level for implementation (J8 and DR records).
		4	Only new structures are to be analyzed. Relocate all structures within designated damage categories which have a zero damage elevation below the specified flood level for implementation (J8 and DR records).
		5	Relocate specified structures (J9 record).
4			Blank field.
5	IPRNT	0	Normal printout for all damage reaches.
		1	Suppress all structure printout.
		2	Suppress damage function printout.
		3	Suppress both damage function and structure printout.
		4	Structure printout controlled by damage reach (DR.8). Suppress damage function printout.
6	ITRACE	0	No trace output.
		1	Trace output desired. Trace output provides detailed results of specified analysis (TR record).
7			Blank field.
8	ITYPE	0	Single event damage will not be calculated.
		-	Number of single event damage values to be calculated (maximum of 10). Negative number indicates flood zone summary output will be suppressed.
		+	Number of single event damage values to be calculated (maximum of 10). Positive number indicates flood zone summary output will be provided.

J1 RECORD (continued)

FIELD	VARIABLE	VALUE	DESCRIPTION
9	IAG	0	No summary of single event damage to be developed.
		1	Summarize single event damage results by aggregate grouping of damage categories (AC record).
		2	Summarize single event damage results by aggregate grouping of damage reaches (AR record).
		3	Summarize single event damage results by aggregate grouping of damage categories and damage reaches (AC and AR records).
10	ISAMP	0	No sampling scaling desired.
		1	Analysis performed to be considered a sample of total structures in flood plain by specified percentage (D3 record).

J2

J2 RECORD (Required)

This **required** record specifies basic information on damage functions, damage categories, damage reaches, file management, and miscellaneous control codes.

Field	Variable	Value	Description
0	KODE	J2	Record identification.
1	NODF	+	Number of sets of damage functions to be input on DF, DP, and PC (or DD) records. Maximum of 50. See J2.9 if use of more functions is desired.
2	NODC	+	Number of unique damage categories (number of DC records), including content categories if used, that will be used to consolidate all structures damage potential for summary printouts and file transfers. Structures without specified categories will be grouped into a category labeled "other". The maximum number of damage categories permitted may be determined from the equation defined on page 2 of main text. A maximum of 50 damage categories may be transferred to the EAD program using DSS.
		-	Same as J2.2 above except that structures without specific categories will not be consolidated (e.g., will be discarded) for summary printout and file transfers.
3	NODR	+	Number of damage reaches. Specify damage reach characteristics on DR records. The maximum number permitted may be determined from the equation defined on page 2 of main text.
4	AGG	+	Elevation tabulation interval (in feet) to be used in construction of damage reach elevation-damage functions. Will be used for all damage reaches.
		0	Elevation tabulation interval (in feet) will be specified for damage reaches on the respective DR records.
5	NFILE	0	Structure data (SL, SD and optional SO, SS, and SA records) are included in SID input data file with other required records.
		1	Structure data (SL, SD, and optional SO, and SA records) resident on tape or disk (unit11) in record image format rather than included in SID input data file.

J2 RECORD (continued)

Field	Variable	Value	Description
6	IMAGE	0	Input records are listed only as they occur during job execution.
		-1	Input records are not listed anywhere in output.
		1	Input record images are printed as a block prior to job execution and also as they occur during job execution.
		2	Input record images are printed as a block only prior to job execution.
7	IELV	0	The number of elevation tabulation values will be 18.
		+	The number of elevation tabulation values to be used in development of the elevation-damage relationships. Maximum = 35.
8	IMARK	0	Structure value only will be used in structure value flood zone summary.
		1	Total value (structure plus contents plus other) will be used for structure value flood zone summary.
9	NDFILE	0	Damage functions values of specific structure (DF, DP and PC (or DD)) included in SID input data file with other required records.
		2	Damage functions (DF, DP and PC (or DD)) resident on tape or disk (unit12) in record image format rather than input by records. See Appendix C.
		92 or 98	Damage functions data (DF, DP and PC (or DD)) resident on a direct access file (unit98). When damage function data are supplied in this form, DF records must also be provided in the job stream to call into the analysis the specific damage functions to be used in the computer run. Specify 92 if DF records are to be supplied on tape or disk file (File 92) in record image format. Specify 98 if DF records are to be included in the SID input data file with other required records. See Appendix C.

J3
JA

J3 RECORD (Optional)

The **optional** J3 records define damage categories to be subjected to raise-to-target elevation analysis. J3 records are required if IPOL (J1.1) is 1 2, 3 or 4. The first field of the initial J3 record defines the number of categories to follow. Subsequent fields (9 per record) are used to specify the damage categories up to a maximum of NODC (J2.2).

Field	Variable	Value	Description
0	KODE	J3	Record identification.
1	NJPOL	+	Number of damage categories to be subjected to raise-to-target analysis and included in subsequent fields. This field is left blank on second and following J3 records.
2	JPOL(1)	AN	Code (DC.2) for first damage category specified for analysis.
3-N	JPOL(2-N)	AN	Code for second and subsequent damage categories specified for analysis. Continue on to additional J3 records as needed, beginning in the second field of additional records. The first field of the second and following records are blank.

JA RECORD (Optional)

The **optional** JA records specify the amount designated structures (J3 record damage categories) are to be raised. JA records are required if IPOL (J1.1) is 3 or 4. The first field is blank with subsequent fields corresponding to the same fields on the J3 record. NJPOL (J3.1) values must be provided.

Field	Variable	Value	Description
0	KODE	JA	Record identification.
1			Blank field.
2	DPOL(1)		Amount (in feet) all structures of designated category JPOL(1)-J3.2 will be raised.
3	DPOL(2)		Amount (in feet) all structures of designated category JPOL(2)-J3.3 will be raised.
4-N	DPOL(3-N)		Same as above.

J4 RECORD (Optional)

The **optional** J4 records identify the structures to be subjected to raise-to-target elevation analysis or evaluated based on raising the structure a specified amount. The J4 record is required if IPOL (J1.1) is equal to 5. The first field of the initial J4 record defines the number of structures to follow. Subsequent fields are used to specify remaining structures (three structures per record). A maximum of 1000 structures may be individually specified for analysis.

Field	Variable	Value	Description
0	KODE	J4	Record identification.
1	NSTR	+	Number of structures to be subjected to raise-to-target flood level elevation analysis.
2	STRPOL(1)	AN	Structure identification code (SL.2) of initial structure to be raised-to-target elevation.
3	TYPOL(1)	1	Raise structure to specified target flood elevation.
		2	Raise structure a specified amount as indicated in Field 4.
4	DEPOL(1)	0	Structure will not be raised specified amount.
		+	Amount structure is to be raised.
5	STRPOL(2)	AN	Same as STRPOL(1) of Field 2 for second structure to be analyzed.
6	TYPOL(2)	1,2	Same as TYPOL(1) of Field 3 for second structure to be analyzed.
7	DEPOL(2)	+	Same as DEPOL(1) of Field 4 for second structure to be analyzed.
8-10	STRPOL(N), TYPOL(N), DEPOL(N)		Same as above for third structure to be analyzed. Repeat for additional structures on subsequent J4 records beginning in Field 2 of each record.

J5
J6

J5 RECORD (Optional)

The **optional** J5 records specify the damage categories to be subjected to flood proofing. J5 records are required if IPROF (J1.2) is equal to 1, 2, 3, or 4. The first field of the initial J5 record defines the number of categories to follow. Subsequent fields (9 per record) are used to specify the damage categories up to a maximum of NODC (J2.2).

Field	Variable	Value	Description
0	KODE	J5	Record identification.
1	NJPRF	+	Number of damage categories to be flood proofed.
2	JPRF(1)	AN	Code (DC.2) for first damage category specified for analysis.
3-10	JPRF(3-N)	AN	Code for the second (and subsequent) damage categories specified for analysis. Continue for as many additional J5 records as needed, beginning in the second field of additional records.

J6 RECORD (Optional)

The **optional** J6 record defines the height of flood proofing in relation to zero damage that is required for the corresponding damage categories on the J5 records. Required only if IPROF (J1.2) is equal to 3 or 4. NJPRF (J5.1) values must be provided.

Field	Variable	Value	Description
0	KODE	J6	Record identification.
1			Leave blank.
2	DPRF(1)	+	Height of flood proofing for initial damage category on the J5 records (in relation to zero damage).
3-N	DPRF(2-N)	+	Height of flood proofing for the second and subsequent corresponding J5 damage categories (in relation to zero damage). Continue on additional J6 records as needed beginning in second field.

J7 RECORD (Optional)

The **optional** J7 record specifies individual structures to be flood proofed and the type of flood proofing associated with each structure. Required if J1.2 is 5. Include 3 structures per J7 record. A maximum of 1000 structures maybe individually specified for analysis.

Field	Variable	Value	Description
0	KODE	J7	Record identification.
1	NSTR	+	Number of structures to be flood proofed.
2	STRPRF(1)	AN	Structure identification code (SL.2) of initial structure to be flood proofed.
3	TYPRF(1)	1	Flood proof structure to specified flood level (DR.4).
		2	Flood proof structure to height specified in Field 4.
4	DEPRF(1)	+	Height of flood proofing for the structure relative to zero damage when TYPRF (J7.3) is equal to 2, otherwise blank.
5,6,7	STRPRF(2) TYPRF(2) DEPRF(2)	AN 1,2 +	Same as above.
8,9,10	STRPRF(3) TYPRF(3) DEPRF(3)	AN	Same as above.
			Repeat above for second and subsequent J7 records as needed, beginning in Field 2 of each record.

J8
J9

J8 RECORD (Optional)

The **optional** J8 record defines damage categories to be subjected to relocation analysis. These records are required if IEVAC (J1.3) is equal to 1, 2, 3, or 4. The first field of the initial J8 record defines the number of categories to follow. Subsequent fields (9 per record) are used to specify damage categories up to a maximum of NODC (J2.2).

Field	Variable	Value	Description
0	KODE	J8	Record identification.
1	NJEVAC	+	Number of damage categories to be subjected to relocation analysis and included in subsequent fields.
2	JEVAC(1)	AN	Code (DC.2) for first damage category to be subjected to relocation analysis.
3-N	JEVAC(2-N)	AN	Code for second and subsequent damage categories specified for analysis. Continue for as many additional J8 records as needed, beginning in second field of additional J8 records.

J9 RECORD (Optional)

The **optional** J9 record specifies the individual structures to be relocated. Required if J1.3 is 5. The first field of the initial J9 record defines the number of structures to follow. Subsequent fields (9 per record) are used to specify the structure identification code of the structures to be analyzed. A maximum of 1000 structures maybe individually specified for analysis.

Field	Variable	Value	Description
0	KODE	J9	Record identification.
1	NSTR	+	Number of structures to be relocated.
2	STREVC(1)	AN	Structure identification code (SL.2) for first structure to be relocated.
3-N	STREVC(2-N)	AN	Structure identification code for second and subsequent structures to be relocated. Continue for additional J9 records as needed beginning in second field.

EVALUATION PRIORITY RECORD

OA RECORD (Optional)

The optional OA record is used to establish the priority order in which the several measures of raising-to-target, flood proofing, and relocation are considered for analysis (if designated on the J1 record). The order will be (1) raising-to-target, (2) flood proofing and (3) relocation if not specified by this record.

Field	Variable	Value	Description
0	KODE	OA	Record identification.
1	IOA(1)	1, 2, or 3	1=raising-to-target analyzed first, 2-flood proofing analyzed first, 3-relocation analyzed first.
2	IOA(2)	1,2, or 3	1=raising-to-target, analyzed second, 2-flood proofing analyzed second, 3-relocation analyzed second.
3	IOA(3)	1,2, or 3	1=raising-to-target analyzed third, 2-flood proofing analyzed third, 3-relocation analyzed third.

TR

TRACE RECORDS

TR RECORD (Optional)

The **optional** TR record specifies the type of trace output to be obtained. Required if ITRACE (J1.6) is 1.

Field	Variable	Value	Description
0	KODE	TR	Record identification.
1	NTRACE	1	Provide detailed trace printout of structures for a designated damage category of a specified damage reach only. Specify damage reach code in TR.2 below.
		2	Provide detailed trace printout for specified structures only (TS records required).
		3	Provide detailed trace printout of structures for designated damage categories of specified damage reaches (TM records required).
2	ITDR	AN	When NTRACE (TR.1) is 1, damage reach to be traced (DR.1), otherwise leave blank.
3	ITDC	AN	When NTRACE (TR.1) is 1, damage category within damage reach to be traced, otherwise leave blank.
4	NSTRS	+	When NTRACE (TR.1) is 2, the number of structures to be traced. Specify structures on TS records. (Maximum of 100).
5	MTRACE	+	When NTRACE (TR.1) is 3, the number of damage reach-damage category combinations to be traced. Specify combinations on TM records. (Maximum of 100)

TS RECORD (Optional)

The **optional** TS record specifies the structures to be traced. Required if NTRACE (TR.1) is 2. If 9 or less structures are traced only one record is required. If more structures are to be traced, they are placed on additional TS records (9 per record). A maximum of 100 structures may be traced.

Field	Variable	Value	Description
0	KODE	TS	Record identification.
1			Field 1 is blank.
2	STRTRC(1)	AN	Identification code (SL.2) of first structure to be traced.
3-(N+1)	STRTRC(2-N)	AN	Identification code of second and subsequent structures to be traced.

TM RECORD (Optional)

The **optional** TM record specifies the damage reach and category combinations to be traced. Required if NTRACE (TR.1) is 3. If 5 or less combinations are traced, only one TM record is required. If more combinations are traced, they are specified on additional TM records. A maximum of 100 damage reach-damage category combinations may be traced.

Field	Variable	Value	Description
0	KODE	TM	Record identification.
1	MDRT(1)	AN	Identification code of damage reach to be traced (DR.1).
2	MDCT(1)	AN	Identification code of corresponding damage category to be traced (DC.2).
3, 4, etc.	MDRT(2) MDCT(2) MDRT(N) MDCT(N)	AN	Damage reach/category to be traced.

ZW

HEC DATA STORAGE SYSTEM RECORD

ZW RECORD (Optional)

The **optional** ZW record triggers the creation of an intermediate file by the HEC Data Storage System (HECDSS) that may subsequently be accessed for further processing of damage data. See Appendix C for further explanation of the HECDSS file. The pathname parts A, E, and F may be entered in either of two formats:

(1) The "HEC standard" method in which the parts are entered in free format. Each part is preceeded by the part identifier (A, E, or F) and an equal sign. A blank column follows each part name. The characters **ZW** must be entered in columns one and two. The format for entering the parts is:

ZW A=study E=data year F=alternative or plan

An example user entry using this format is:

ZW A=SILVER CREEK E=1990 F=BASELINE

(2) The "old" method in which the parts are entered in fixed format as documented below. Part A is entered in columns 3 through 16, part F in columns 17 through 40, and part E in columns 45 through 48.

Field	Variable	Value	Description
0	KODE	ZW	Record identification.
1-2	PROJ(1)	AN	Project pathname label (part A).
3-5	ALT	AN	Alternative pathname label (part F).
6 (45-48)	IYR	AN	Output data year (part E) is to be specified in pathname label.

DAMAGE FUNCTION RECORDS

These **required** records are required if NDFILE (J2.9) is not equal to 92. Three record types DF, DP and PC (or DD) are required for each damage function. There must be NODF (J2.1) sets of DF, DP, PC (or DD) records.

DF RECORD (Required)

The **required** DF record identifies the damage function, specifies the number of depth tabulation values, and flags the nature of the damage values and file source. If NDFILE (J2.9) is 92, the DF record is required on tape or disk. If NDFILE (J2.9) is 92 or 98, damage function data is resident on direct access file 98 created by the SIDEDT computer program. DF records must be included in the job stream to retrieve from the direct access file those damage functions to be used in the specific computer run. If NDFILE (J2.9) is 92, provide DF in records tape or disk, specifying the appropriate identification codes (DF.1) and IDFILE (DF.4) as 1. If NDFILE (J2.9) is 98, provide DF records as part of data input specifying (DF.1) as before and DF.4 as 1.

Field	Variable	Value	Description
0	KODE	DF	Record identification.
1 (6-8)	IT	AN	Damage function identification code (maximum of 3 characters).
2	NSTAG	+	Number of stage tabulation values - maximum of 20.
3	IDF	0	Damage values placed on PC records are PERCENT damage values.
		1	Damage values placed on DD records are direct (actual) DOLLAR values.
4	IDFILE	0	Stage and damage data are included in data input stream or (DF, DP, PC (or DD)) record images exist on a computer disk file. NDFILE (J2.9) = 0 or 2.
		1	Stage and damage data (DF, DP, PC (or DD)) are resident on a direct access file. NDFILE (J2.9) = 92 or 98.

DP

DP RECORD (Required)

The required DP record specifies the stage values (of stage-damage functions). The first 10 stage values are placed on the initial DP record and the remainder, if needed, are placed on a second DP record (maximum of 20). The initial stage tabulation value should correspond to the zero damage point. Values are input in ascending order but do not have to be of a uniform interval between values. Elevation values instead of stage values are assumed if STOPO (SL.6) is equal to zero. Required if NDFILE (J2.9) is 0 or blank.

Field	Variable	Value	Description
0	KODE	DP	Record identification.
1	SAGE(1)	+	First stage value. May be negative (use "-" sign) and must correspond to zero damage. If the damage function represents a basement function, account for the difference between the elevation of the basement floor and the first floor elevation on the SL record, field 8 (DELTZ).
2	SAGE(2)	+	Second stage value. May be negative (use "-" sign).
N	SAGE(N)	+	Same as above for NSTAG (DF.2) stage values. Continue for as many DP records as needed.

PC RECORD (Optional)

The **optional** PC records specify the percent damage values corresponding to the stage values specified on the DP record(s). The first 10 values are placed on the initial PC record and the remainder, if needed, are placed on a second PC record. The first depth (DP.1) and associated percent damage (PC.1) values must correspond to zero damage point. Required if IDF (DF.3) is 0 or blank and NDFILE (J2.9) is 0 or blank.

Field	Variable	Value	Description
0	KODE	PC	Record identification.
1	PERCNT(1)	+	Percent damage in whole numbers (e.g., 60% is input as 60) corresponding to first depth value. Initial value must be zero.
2	PERCNT(2)	+	Percent damage (in whole numbers) corresponding to second depth value.
N	PERCNT(N)	+	Percent damage corresponding to N depth value. Continue for as many PC records as needed.

DD RECORD (Optional)

The **optional** DD record is an optional alternative to the PC record to specify direct damage values corresponding to the stage values on the DP record(s). The first 10 direct damage values are placed on the first DD record and the remainder, if needed, are placed on a second DD record. The first depth (DP.1) and direct damage (DD.1) values must correspond to a zero damage point. Required if IDF (DF.3) is 1 and NDFILE (J2.9) is 0 or blank.

Field	Variable	Value	Description
0	KODE	DD	Record identification.
1	PERCNT(1)	+	Direct damage in thousands of dollars ($1000) corresponding to initial depth value (initial value must be zero).
2	PERCNT(2)	+	Direct damage in thousands of dollars ($1000) corresponding to second depth value.
N	PERCNT(N)	+	Direct damage in thousands of dollars ($1000) corresponding to NSTAG (DF.2) depth value. Continue for as many DD record as needed.

DC

DAMAGE CATEGORY RECORDS

DC RECORD (Required)

The required DC records identify and describe damage categories to be used to consolidate the number of damage potential values of all structures. Categories may comprise of a category for similar types of structures and associated contents and "other" items, or a category for content damage only. The defined categories are used in summary printout and computer file transfers. NODC (J2.2) DC records are required.

Field	Variable	Value	Description
0	KODE	DC	Record identification.
1			Blank field.
2	JDCT	AN	Damage category identification code. Identifier for category into which individual damage potential associated with the structure (structure, contents, other), or content only damage potential, will be consolidated for summary printout and computer file transfers.
3	POLMAX	+	Maximum elevation change (in feet) that will be permitted for this category if raise-to-target elevation analysis performed. No restriction specified if blank.
4	PRFMAX	+	Maximum amount of flood proofing (in feet) that will be permitted for this category if flood proof to target elevation analysis is performed. No restriction if left blank.
5-10	TITDC	AN	Title to be associated with damage category identification code JDCT (DC.2) specified above.

CC RECORD (Optional)

The **optional** CC records specify and describe content damage categories to be evaluated and displayed. There should be a set of CC records for each content damage category specified on the DC records. If more than 8 damage categories from the DC records are to be aggregated into a content damage category on the CC record they are input on subsequent CC records beginning in the second field. A new set of CC records is required for each content damage category.

Field	Variable	Value	Description
0	KODE	CC	Record identification.
1	NCATS	+	Number of damage categories on DC records to be aggregated into this content damage category.
2	ICCT	AN	Content damage category identification. Same as JDCT (DC.2) for this category.
3	ICATS(1)	AN	Identification of first damage category from DC records to be aggregated into this content damage category.
4	ICATS(2)	AN	Identification of second damage category from DC records to be aggregated into this content damage category.
5-N	ICATS(5-N)	AN	Same as Fields 3 and 4 for NCATS (CC.1) categories.

DR

DAMAGE REACH RECORDS

Damage reach records are required for each reach to be analyzed. There must be NODR (J2.3) sets of DR, DT (and optional SE and D3) records.

DR RECORD (Required)

The **required** DR record specifies the damage reach code and provides input of relevant water elevation data for the selected index location within the damage reach.

Field	Variable	Value	Description
0	KODE	DR	Record identification.
1	JDR	AN	Damage reach identification code. If ZW record included, this field specifies the "location" of the DSS pathname (part B). See Appendix C.
2	REFFLD	+	Elevation of the reference flood at the index location for this damage reach.
3	POLELV	+	Target water surface elevation at the index location for raise-to-target analysis specified for IPOL (J1.1). Blank if IPOL is blank, 0, 3 or 4.
4	PROELV	+	Target water surface elevation at the index location for flood proof to target flood level analysis specified for IPROF (J1.2). Blank if IPROF is blank, 0, 3 or 4.
5	EVCELV	+	Target water surface elevation at the index location for structure relocation specified for IEVAC (J1.3). Blank if IEVAC is left blank or zero.
6	STRELV	+	Water surface elevation at index location that will be used as starting tabulation elevation for elevation-damage function development. Should be slightly lower than elevation at which damage is expected to begin.
7	ELINTR	blank,+	Elevation tabulation increment at which damage potential will be computed, printed, and stored. Elevation-damage function will be started at STRELV (DR.6) and be tabulated at IELV (J2.7) intervals of ELINTR increments. If AGG (J2.4) is a positive number, this field may be left blank. If both AGG (J2.4) and ELINTR are entered, ELINTR overides variable AGG.

DR RECORD (continued)

Field	Variable	Value	Description
8	IDPRT	blank	Leave this field blank if IPRNT (J1.5) is not equal to four.
		0	If IPRNT (J1.5) equals 4 and IDPRT equals 0 (zero), then the structure information WILL NOT be printed.
		1	If IPRNT (J1.5) equals 4 and IDPRT equals 1, then the structure information WILL be printed.
9	ID3	0	Sample scaling adjustment is not desired for this reach.
		1	Sample scaling has been specified (ISAMP, J1.10) and percentages will be provided on D3 records.

DT RECORD (Required)

The **required** DT record provides title information.

Field	Variable	Value	Description
0	KODE	DT	Record identification.
1-10	DTITLE	AN	Title and/or description of damage reach specified as JDR (DR.1) on previous DR record.

SE

SE RECORD (Optional)

The **optional** SE record specifies the water surface elevations to be used for single flood event analysis. Required if ITYPE (J1.8) is non-zero. The water surface elevation must be entered in increasing order.

Field	Variable	Value	Description
0	KODE	SE	Record identification.
1	SINGLE(1)	+	Water surface elevation at the index location within damage reach JDR (DR.1) (specified on previous DR record) for the first single flood event to be analyzed. The title for this event will be specified on the ST record following all damage reach record sets.
2	SINGLE(2)	+	Water surface elevation at the index location for second (and subsequent) events (up to 10) to be analyzed. The title for these events will be specified on the ST record following all damage reach record sets.
N	SINGLE(N)	+	Water surface elevation at the index location for N events (up to 10). The title for each event is specified on ST records following all damage reach record sets.

D3 RECORD (Optional)

The **optional** D3 record specifies the scaling percentages that will be used to adjust the damage functions. The consolidated damage potential will be scaled as the reciprocal of the value specified. D3 record(s) are required if ISAMP (J1.10) is 1.

Field	Variable	Value	Description
0	KODE	D3	Record identification.
1	SAMPLE(1)	+	Percent sampling performed for structures consolidated into damage category JDCT (DC.2) in first DC record. Input as whole number (e.g., 60% is 60).
2	SAMPLE(2)	+	Percent sampling performed for structures consolidated into damage category JDCT (DC.2). Input as whole number (e.g., 60% is 60).
N	SAMPLE(N)	+	Percent sampling performed for structures consolidated into damage category JDCT (DC.N). Input as whole number (e.g., 60% is 60). Continue on to additional D3 records as needed beginning in first field of additional records, NODC (J2.2) values required. Leave content damage category fields blank.

ST RECORD (Optional)

The **optional** ST record follows the complete NODR (J2.3) sets of damage reach records (D4, DT, SE, and D3 records) and provides title information for the single flood events specified on each of the SE records. This record is required if ITYPE (J1.8) is not equal to zero.

Field	Variable	Value	Description
0	KODE	ST	Record identification.
1	SEVTIT(1)	AN	Title for first single flood event elevation specified on SE records (SE.1).
2	SEVTIT(2)	AN	Title for second single flood event elevation specified on SE records.
N	SEVTIT(N)	AN	Title for N single flood event elevation specified on SE records (SE.N). Up to ITYPE (J1.8) titles.

AC

AC RECORD (Optional)

The **optional** AC record is used to specify a reduced set of damage categories for summarizing (for output display only) the results from single flood event analysis. Several damage categories can be combined into a single category for printout display purposes. Required if IAG (J1.9) is 1 or 3.

Field	Variable	Value	Description
0	KODE	AC	Record identification.
1	NAGGDC	+	Number of aggregated new damage categories. Maximum is 30.
2	IAGGDC(1)	AN	Identification code for the aggregated new damage category in which the damage for the first damage category specified on the first DC (damage category) record is placed. The identification code will be used to label the output.
3	IAGGDC(2)	AN	The aggregated new damage category in which the damage for the damage category specified on the second DC (damage category) record is placed.
N	IAGGDC(N)	AN	Etc., NODC (J2.2) items. Continue on to additional AC records as needed starting in the second field.

AR RECORD (Optional)

The **optional** AR record is used to specify a reduced set of damage reaches for summarizing (for output display only) the results from single flood event analysis. Several damage reaches can be combined into a single reach for printout display purposes. Required if IAG (J1.9) is 2 or 3.

Field	Variable	Value	Description
0	KODE	AR	Record identification.
1	NAGGDR	+	Number of aggregated new damage reaches. Maximum is 30.
2	IAGGDR(1)	AN	Identification code for the aggregated new damage reach in which the damage for the damage reach specified on the first set of DR (damage reach) records is placed. The identification code will be used to label the output.
3	IAGGDR(2)	AN	Identification code for the aggregated new damage reach in which the damage for the damage reach specified on the second set of DR (damage reach) records is placed.
N	IAGGDR(N)	AN	Etc., NODR (J2.3) items. Continue on to additional AR records as needed starting in the second field.

SL

STRUCTURE INVENTORY RECORDS

The structure records which follow (SL and SD required, SO, SS and SA optional) provide the basic inventory data for the structures to be subjected to damage potential analysis. The SS and SA records do not presently result in analysis. They have been defined so that future applications (that might be developed) could be accommodated in initial field data collection efforts.

SL RECORD (Required)

This **required** record provides identification codes, locational information, structure elevations, and printout controls. The numbers in parentheses under FIELD are the record column numbers for input.

Field	Variable	Value	Description
0	KODE	SL	Record identification.
1	IDRCH	AN	Damage reach identification code that will be used for structure damage potential aggregation for damage potential function construction, summary printout, and file transfer. The structure is presumed to be located within this specified damage reach.
2	IBLDG	AN	Structure identification code. Used for all subsequent accounting, and storage and retrieval of data for this structure.
3	ROWN	+,-	If coordinates are used this value is the row or north coordinate point. Any rectilinear coordinate system may be used such as row/column or the Universal Transverse Mercator (UTM) system.
4	COLE	+,-	If coordinates are used, this value is the column or east coordinate point.
5	ADJ	+	Elevation of the reference flood at the structure (in feet). Used (in conjunction with damage reach reference flood elevation) to adjust structure elevation-damage potential at site to the index location.
6	STOPO	+	Elevation of reference point selected for structure (in feet). Must be input as either (1) first floor elevation or (2) ground elevation. If elevation is input as ground elevation, will be adjusted to first floor by addition of DELTG (SL.9). The first floor elevation corresponds to the zero stage value on stage-damage function (DF, DP, PC (or DD) records). If left blank, or assigned as zero stage, values on DP record are assumed to elevation values.

SL RECORD (continued)

Field	Variable	Value	Description
7	DELTZ	+,-	Distance between water surface elevation that can cause damage to begin and first floor. For example, if a basement opening exists that would admit water at some elevation above the basement floor, damage might not begin until water reaches that elevation. If the point is below first floor elevation, elevation difference input should be negative (e.g., preceded by a minus sign). Only the structure and content damage functions are adjusted, the "other" damage function is not adjusted.
8	DELTB	+,-	Distance between elevation of basement floor and first floor elevation. Elevation difference input would normally be negative (e.g., preceded by a minus sign). Needed if structure has a basement and separate damage function is to be used for basement only.
9	DELTG	+,-	Used only if elevation STOPO (SL.6) was input as ground elevation. Needed to adjust STOPO to first floor elevation. Distance between elevation of first floor and ground elevation. If first floor elevation is above ground, elevation difference is positive and should be so input.
10 (73-74)	IFUNC	0	Analysis to be performed uses a single level damage function and only SD records will be included. SO, SS or SA records are not used.
		1	One additional structure record (either a SO, SS, SA record) will be included with the required SL and SD records.
		2	Two additional structure records (either SO and SS, SO and SA, or SS and SA records) will be included with the required SL and SD records.
		3	Three additional structure records (SO, SS, and SA records) will be included with the required SL and SD records.
10 (75)	NEWSTR	0	Structure will be considered as "existing" for analysis purposes.
		1	Structure will be considered as "new" (e.g., does not presently exist but will be built at some future date) for analysis purposes.

SD

SD RECORD (Required)

The **required** SD record specifies the damage category (for damage potential consolidation), damage function assignments, and values for structures and contents. The numbers in parentheses under FIELD are the column numbers for input.

Field	Variable	Value	Description
0	KODE	SD	Record identification.
1	IDRCH	AN	Damage reach identification code (identical to SL.1).
2	IBLDG	AN	Building identification code (identical to SL.2).
3	IDCAT	AN	Damage category (specified on DC records) JDCT (DC.2) to which this structure will be assigned for consolidation of damage potential of all structures.
4 (25-27)	ID1FS	AN	Identification code for damage potential function to be assigned to this structure. Use appropriate DF record identification code, IT (DF.1).
4 (28-32)	V1FS	+	Total value of structure in thousands of dollars ($1000). If damage function to be assigned to this value is a percent function, this value provides the conversion. Otherwise the value input here is used in various tables and summaries.
5 (33-35)	ID1FC	AN	Identification code for damage potential function to be assigned to damage to contents for this structure. Use appropriate DF record identification code, IT (DF.1).
5 (36-40)	V1FC	+	Total value contents in thousands of dollars ($1000).
		-	Value of contents is a percentage of the structure value. Input as negative whole number (e.g., 50% is input as -50).
6 (41-43)	ID1FO	AN	Identification code for damage potential function to be used for damage to "other" items. Use appropriate DF record identification code, IT (DF.1).
6 (44-48)	V1FO	+	Total value of "other" items in thousands of dollars ($1000).
		-	Value of "other" is a percentage of the structure value. Input as a negative whole number (e.g., 5% is input as -5).
7-10	IADDR	AN	Space allowed for comment/record keeping. Not stored or saved. Could be used to record address, source of structure market values, land costs, or other miscellaneous information.

SO RECORD (Optional)

The **optional** (see IFUNC (SL.10)) SO record provides for additional specification of analysis for the basement and above first floor categories for those users who desire to evaluate structures at three levels. In this case, the SD record is then used to provide only first floor information. The numbers in parentheses under FIELD are the record column numbers for input.

Field	Variable	Value	Description
0	KODE	SO	Record identification.
1	IDRCH	AN	Damage reach identification code (identical to SL.1).
2	IBLDG	AN	Building identification code (identical to SL.2).
3 (17-19)	IDBS	AN	Identification code for damage potential function to be assigned for damage to the structure of the basement. Use appropriate DF record identification code, IT (DF.1).
3 (20-24)	VBS	+	Total value of the structure of the basement in thousands of dollars ($1000).
4 (25-27)	IDBC	AN	Identification code for damage potential function to be assigned to damage to contents of the basement. Use appropriate DF record identification, IT (DF.1).
4 (28-32)	VBC	+	Total value of the contents of the basement in thousands of dollars ($1000).
		-	Value of the contents of the basement is a percentage of the structure value of the basement. Input as negative whole number (e.g., 50% is input as -50).
5 (33-35)	IDBO	AN	Identification code for damage potential function to be assigned for damage to "other" items of the basement. Use appropriate DF record identification code, IT (DF.1).
5 (36-40)	VBO	+	Total value of the "other" items of the basement in thousands of dollars ($1000).
		-	Value of the "other" items of the basement is a percentage of the structure value of the basement. Input as negative whole number (e.g., 50% is input as -50).
6 (41-43)	IDAS	AN	Identification code for damage potential function to be assigned for damage to the structural portion above the first floor. Use appropriate DF record identification code, IT (DF.1).
6 (44-48)	VAS	+	Total value of the structural portion above the first floor in thousands of dollars ($1000).
7 (49-51)	IDAC	AN	Identification code for damage potential function to be assigned for damage to the contents above the first floor. Use appropriate DF record identification, IT (DF.1).

SO

SO RECORD (continued)

Field	Variable	Value	Description
7 (52-56)	VAC	+	Total value of the contents above the floor in thousands of dollars ($1000).
		-	Value of the contents for above first floor is a percentage of the structural portion above first floor value. Input as negative whole number (e.g., 50% is input as -50).
8 (57-59)	IDAO	AN	Identification code for damage potential function to be assigned for damage to "other" items above first floor. Use appropriate DF record identification, IT (DF.1).
8	VAO	+	Total value of the "other" items above the first (60-64) floor in thousands of dollars ($1000).
		-	Value of the "other" for above first floor is a percentage of the structural portion above first floor value. Input as negative whole number (e.g., 50% is input as -50).
9	RVMILE	+	River mile associated with this structure. This is used to calculate the reference flood elevation for each structure by interpolation of the calculated water surface profiles from HEC-2. Calculations are done by the "FDA2PO" computer program. Leave blank if the reference flood elevation is entered in field SL.5 (variable ADJ). SID currently ignores this field.
10	STOIDX	+	Computed structure reference elevation at the index location. Calculations are done by the "FDA2PO" computer program. SID currently ignores this field but SIDEDT recognizes this field as valid.

STRUCTURE CHARACTERISTICS/DOCUMENTATION RECORDS

The SS and SA records have been formulated to provide a systematic data capture procedure for cataloging more precisely the characteristics of inventoried structures. The data contained on these records are simply read and printed. Future plans for enhancement of SID capabilities include sort, display, and summary operations on these data items, and later, creation of analysis routines to permit refined nonstructural and other analysis.

SS RECORD (Optional)

The **optional** SS record (see IFUNC (SL.10)) provides for cataloging more detailed information on the structure to allow for potential, (not yet developed) more detailed, economic and nonstructural analysis. The numbers in parentheses under FIELD are the column numbers for input.

Field	Variable	Value	Description
0	KODE	SS	Record identification.
1	IDRCH	AN	Identification code of damage reach to which this structure is assigned (identical to SL.1).
2	IBLDG	AN	Building identification code (identical to SL.2).
3 (17-20)	YC	+	Year of completion of structure construction (e.g., 1952). Used as indicator of age of structure.
3 (21-22)	SF	AN	Soil foundation types used to determine seepage/construction problems/potential. Up to 5 types (defined by user) may be specified. An example might be: 1 Gravel 2 Rock 3 Impervious 4 Swampy 5 Other
3 (23-24)	TG	AN	Categorization of structure types used as indicators of nature of construction and for statistical analysis. Up to 20 types (defined by user) may be specified. An example might be: 1 Colonial 2 Ranch 3 Row 4 Trailer, etc. n Etc.

SS

SS RECORD (continued)

Field	Variable	Value	Description
4 (25-26)	CG	AN	Categorization of construction type. Used as indicator for potential modifications. Up to 10 categories (defined by user) may be specified. An example might be: 1 Wood frame 2 Prefab 3 Masonry 4 Steel frame Etc.
4 (27-28)	NG	+	Code for number of floors (not including basement: 1 One floor 2 Two floors 3 More than two floors
4 (29-30)	BG	+	Code for presence of basement. 0 No basement. 1 Structure has a basement.
5 (33-34)	BT	AN	Categorization of basement type. Up to 5 categories (user defined) may be specified. An example might be: 1 Full 2 Partial 3 None, slab foundation n Etc.
5 (35-36)	BC	AN	Code for basement construction type. Up to 10 types (user defined) may be specified. An example might be: 1 Wood frame 2 Prefab 3 Masonry 4 Steel frame, etc. Etc.
5 (37-40)	BSIZE	+	Basement area in hundred square feet.
6 (41-42)	NWB	+	Number of windows below the first floor.
6 (43-45)	WAB	+	Average size of the window openings below the first floor (square feet).
6 (46-48)	WBF	+	Elevation difference between the lowest window below the first floor and the first floor reference point.
7 (49-50)	NOB	+	Number of "other" openings below the first floor.

SS RECORD (continued)

Field	Variable	Value	Description
7 (51-53)	OAD	+	Average size of the "other" openings below the first floor (square feet).
7 (54-56)	OBF	+	Elevation difference between the lowest "other" openings below the first floor and the first floor reference point.
8 (57-58)			Blank.
8 (59-60)	FC	+	Code for first floor construction type. Up to 10 types (user defined) may be specified. An example might be: 1 Wood frame 2 Prefab 3 Masonry 4 Steel frame, etc. n Etc.
8 (61-64)	FSIZE	+	First floor area in hundred square feet.
9 (65-66)	NWF	+	Number of windows in the first floor.
9 (67-69)	WAF	+	Average size of window openings on first floor (square feet).
9 (70-72)	WDF	+	Elevation difference between the lowest window above the first floor and the first floor reference point elevation.
10 (73-74)	NOF	+	Number of "other" openings above the first floor elevation.
10 (75-77)	OAF	+	Average size of "other" openings above the first floor elevation (square feet).
10 (78-80)	ODF	+	Elevation difference between the lowest "other" openings above the first floor and the first floor reference elevation.

SA

SA RECORD (Optional)

The **optional** SA record (see IFUNC (SL.10)) provides for additional cataloging and naming of the structure (e.g., resident or business) and record keeping such as street address.

Field	Variable	Value	Description
0	KODE	SA	Record identification.
1	IDRCH	AN	Identification code for the damage reach to which structure is assigned (identical to SL.1).
2	IBLDG	AN	Building/structure identification code (identical to SL.1).
3,4	RESID	AN	Name of resident or business.
5-7	ADDR	AN	Street address.
8-9	CITY	AN	City or town.
10	IZIP	+	Zip code.

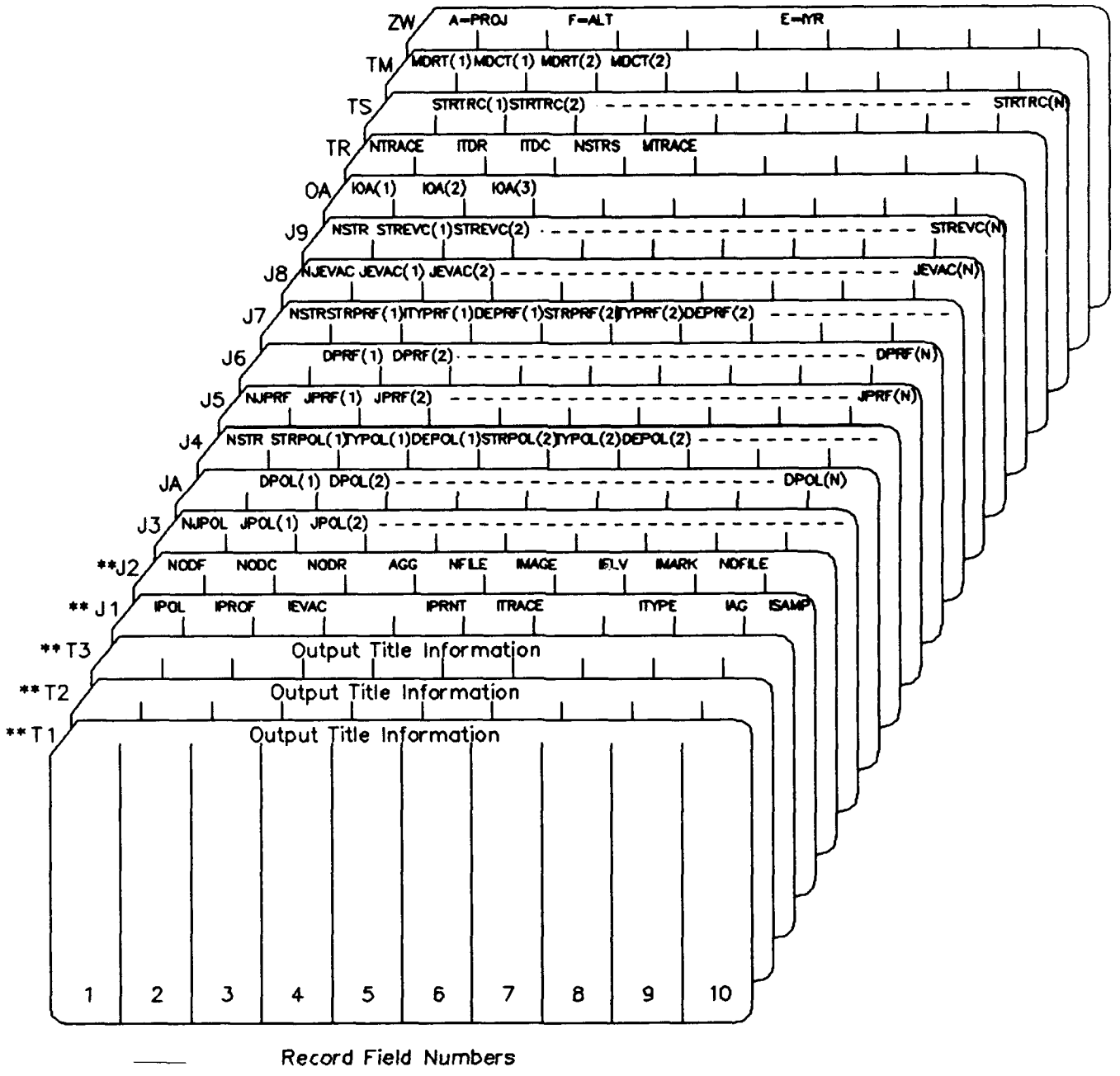
ES RECORD (Required)

The required ES record follows the last set of structure records (SL - SA).

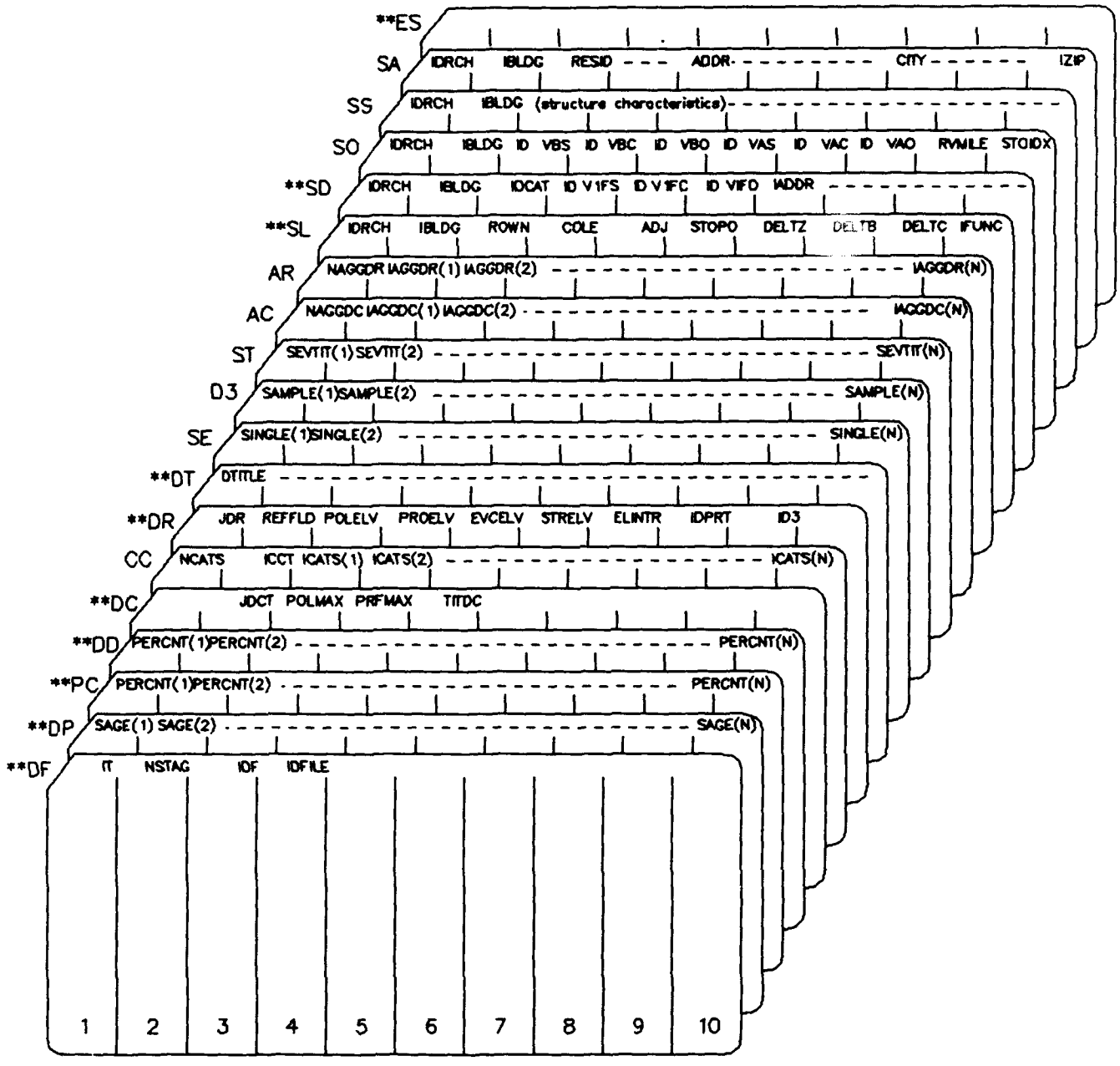
Field	Variable	Value	Description
0	KODE	ES	Record identification.

APPENDIX F

Input Record Schematic



** Required Record



Record Field Numbers

** Required Record

GPO 785-066/20059